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City of Miles City

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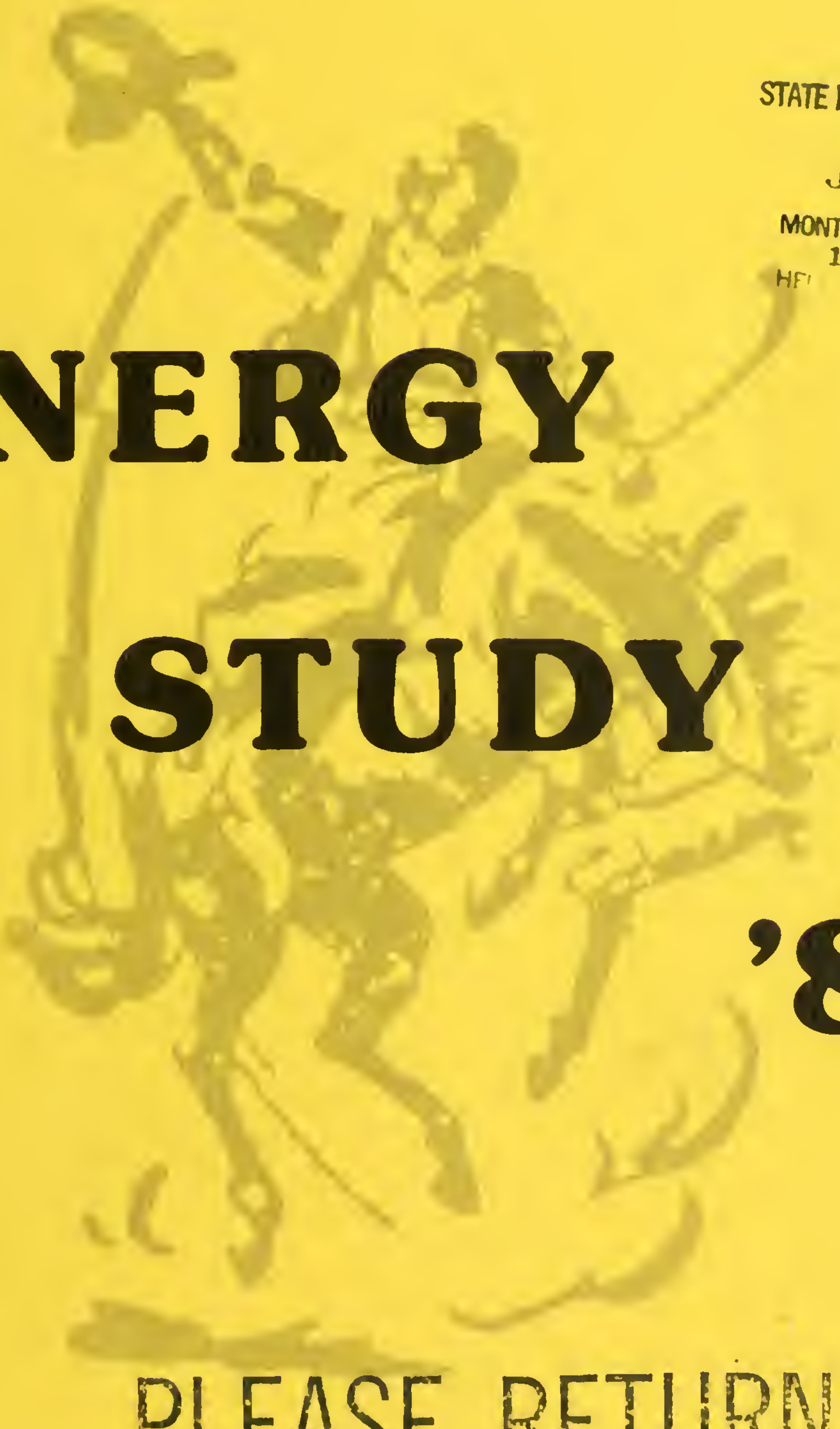

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CITY OF MILES CITY

ENERGY STUDY ' 82

CITIZEN TASK FORCE

"Bus" Beals

Dick Graham

Dick Mitchell, Jr.

Pat Rogers

Ron Semingson

Art Taft

Sharon Wenholz

STUDY STAFF

John Kimball

Mike Strouf

Lenn Hulford

Linda Wildman

FUNDED BY

Montana Department of Natural Resources

and Conservation Energy Division

32 S. Ewing, Helena, Montana 59620

TABLE OF CONTENTS

CHAPTER PAGE

1. INTRODUCTION.. 1

2. HISTORICAL USE DATA

Total City Motor Fuels/Cost.............................. 2
Total City Electrical/Cost............................... 3
Total City Natural Gas/Cost.............................. 4
City Hall Electrical Use/Cost............................ 5
City Hall Natural Gas Use/Cost........................... 6
Library Electrical Use/Cost.............................. 7
Library Natural Gas Use/Cost............................. 8
City Shop Electrical Use/Cost............................ 9
City Shop Natural Gas Use/Cost........................... 10
Fire Hall Electrical Use/Cost............................ 11
Fire Hall Natural Gas Use/Cost........................... 12
Airport Electrical Use/Cost.............................. 13
Airport Natural Gas Use/Cost............................. 14
Water Plant Electrical Use/Cost.......................... 15
Water Plant Natural Gas Use/Cost......................... 16

3. PROJECTED ENERGY CONSUMPTION/COST THROUGH 1990 ASSUMING NO CHANGE IN CITY OPERATIONS............................... 17

4. HEAT LOSS CALCULATIONS, COMMENTS AND SPECIFIC RECOMMENDATIONS FOR TOTAL CITY AND SIX SEPERATE DEPARTMENTS.......... 18

5. PROJECTED ENERGY CONSUMPTION/COST THROUGH 1987 WITH AND WITHOUT RETROFITS.................................... 36

6. APPENDIX.. 37

The following energy study was financed by a grant from the State of Montana, Department of Natural Resources and Conservation. The study marks the beginning of energy use monitoring by the City and hopefully will mark the beginning of an aggressive posture by city government to conserve.

In order to analyze todays energy usage, it is necessary to establish a historical data base. Data was obtained on natural gas, electrical and motor fuel usage. For purposes of this study, energy use from January 1979 to July 1982 was compiled. The data base allows either calendar year calculations or fiscal year calculations.

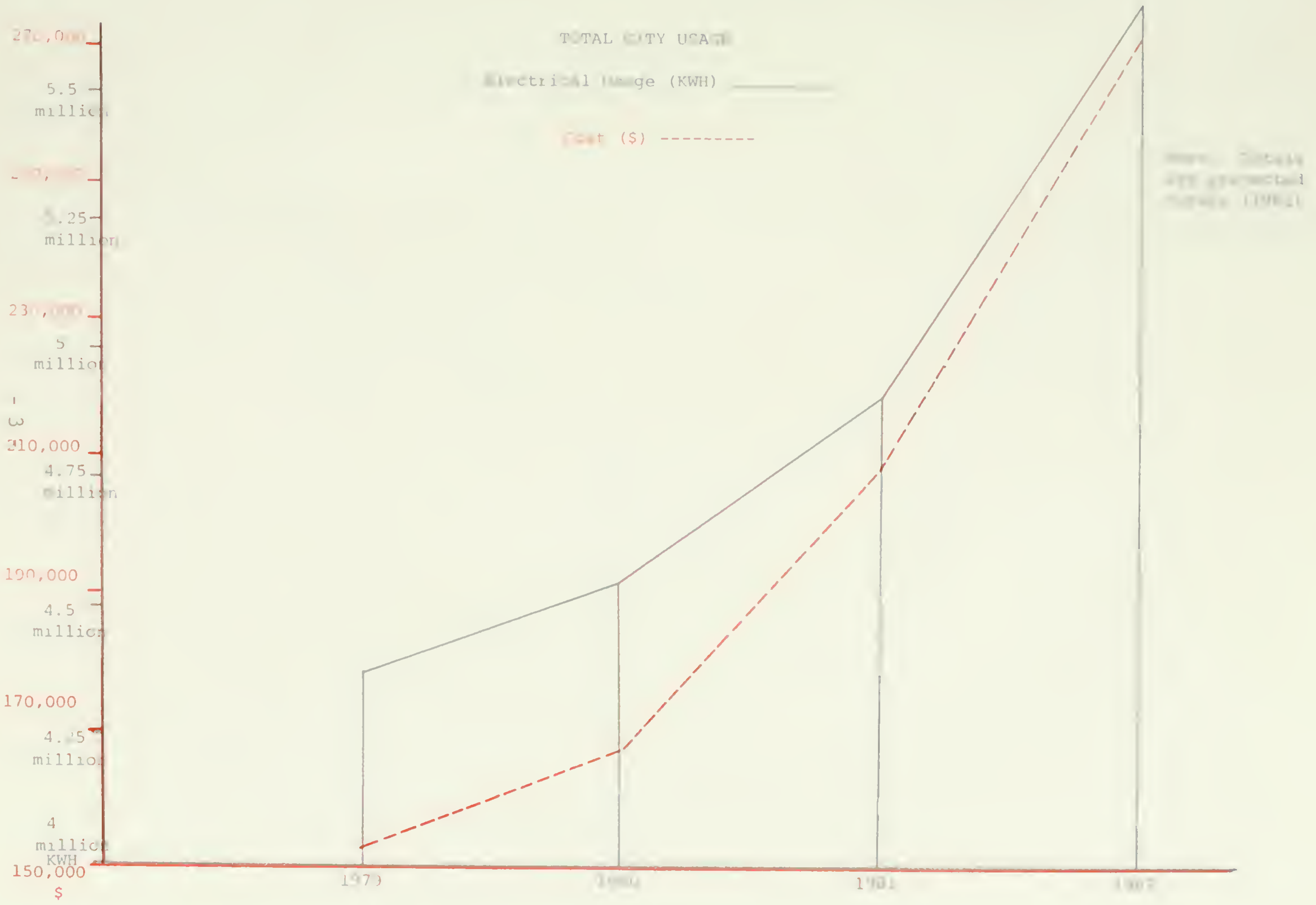
Six individual departments received heat loss calculations on buildings housing their operations. The heat loss calculations resulted in general comments and specific recommendations in regards to conservation of usage. Specific recommendations are estimated for cost, cost savings and payback period. All calculations are based on September 1982 prices for utilities.

Energy use predictions were calculated to 1990 and cost predictions projected using rate schedules provided by the utilities suppliers. The 1990 projections assume no change in management posture. Projections (use and cost) were calculated to 1987 assuming that management followed specific recommendations and internalized general comments into future decisions.

CITY OF MILES CITY

MOTOR FUELS - HISTORICAL USAGE

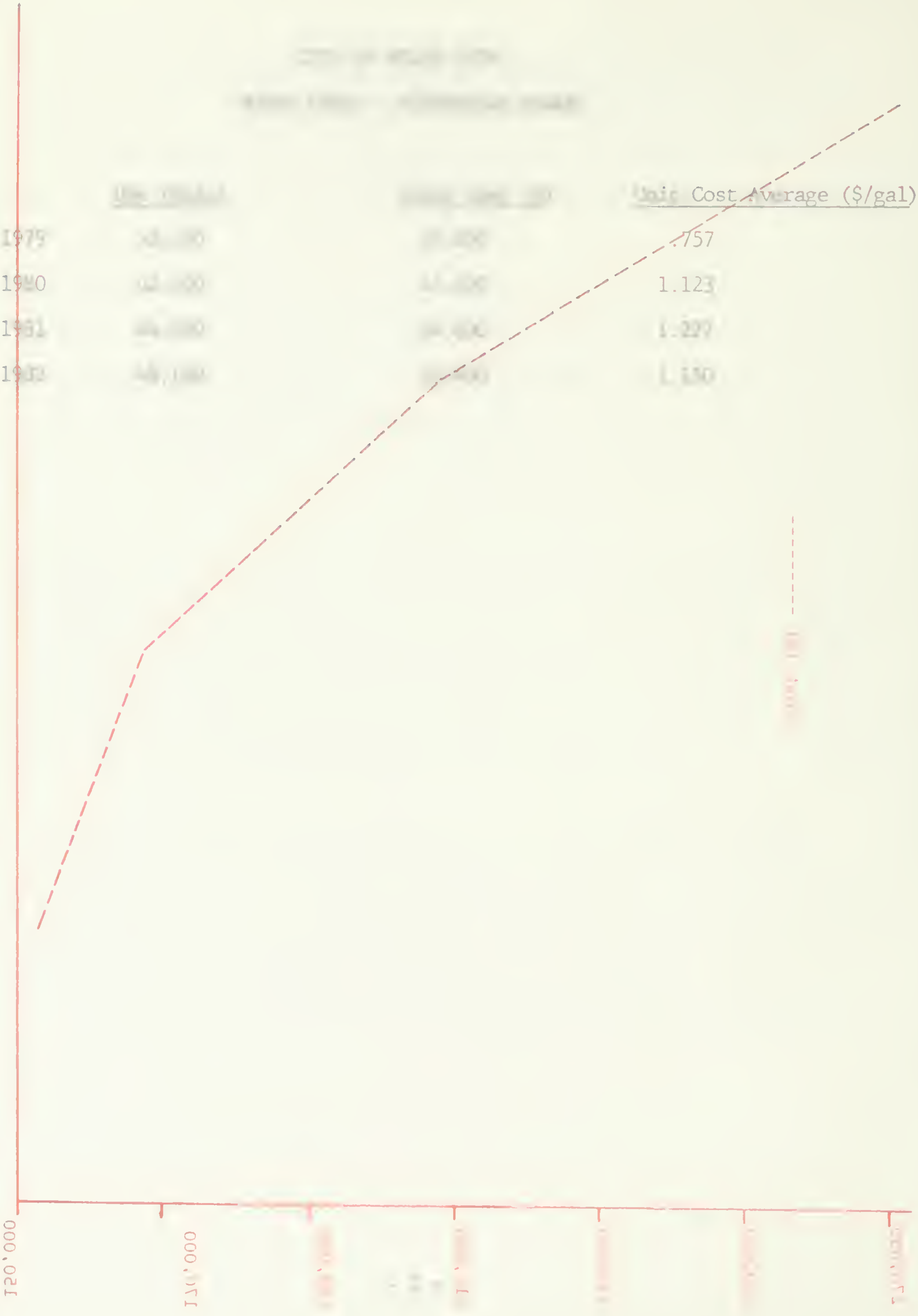
	Use (Gals)	Total Cost ($)	Unit Cost Average ($/gal)
1979	53,100	40,200	.757
1980	42,300	47,500	1.123
1981	44,500	54,600	1.227
1982	48,180	55,400	1.150


TOTAL CITY USAGE
Electrical Usage (KWH) ————
Cost ($) ---------
270,000
5.5 million
250,000
5.25 million
230,000
5 million
210,000
4.75 million
190,000
4.5 million
170,000
4.25 million
4 million KWH
150,000 $
1979
1980
1981
1987
Note: Totals are projected figures (1982)

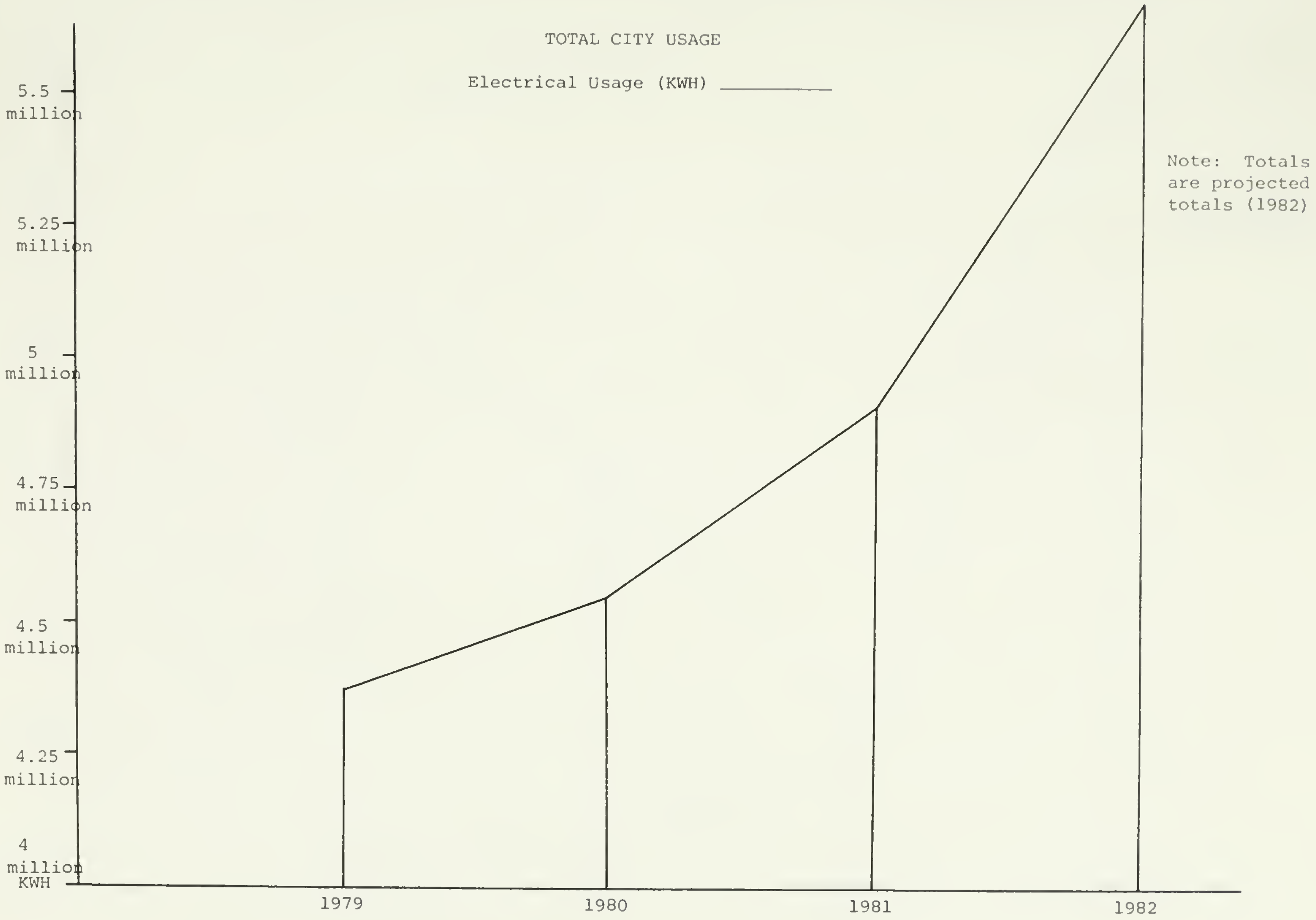
[illegible]

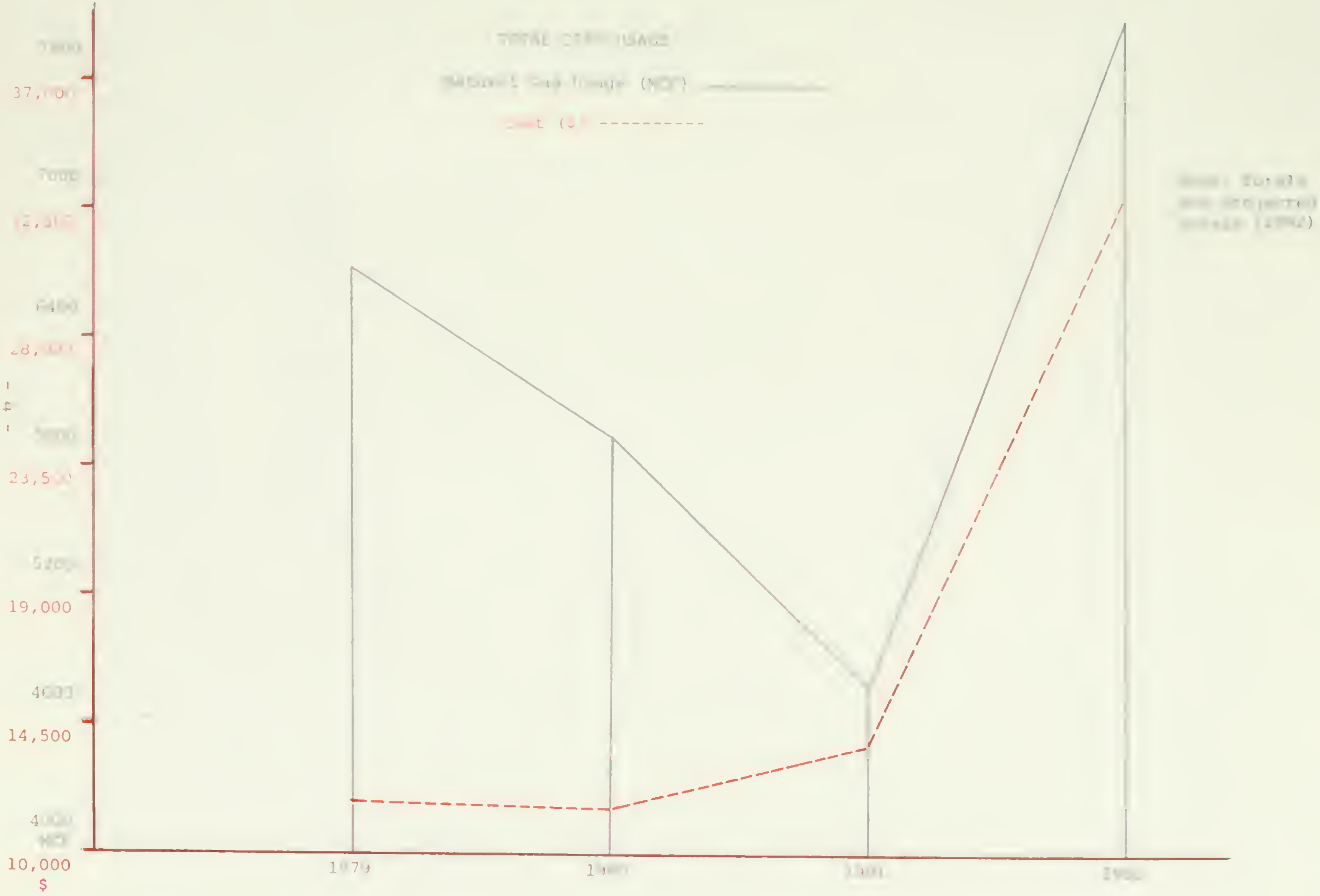
[illegible]

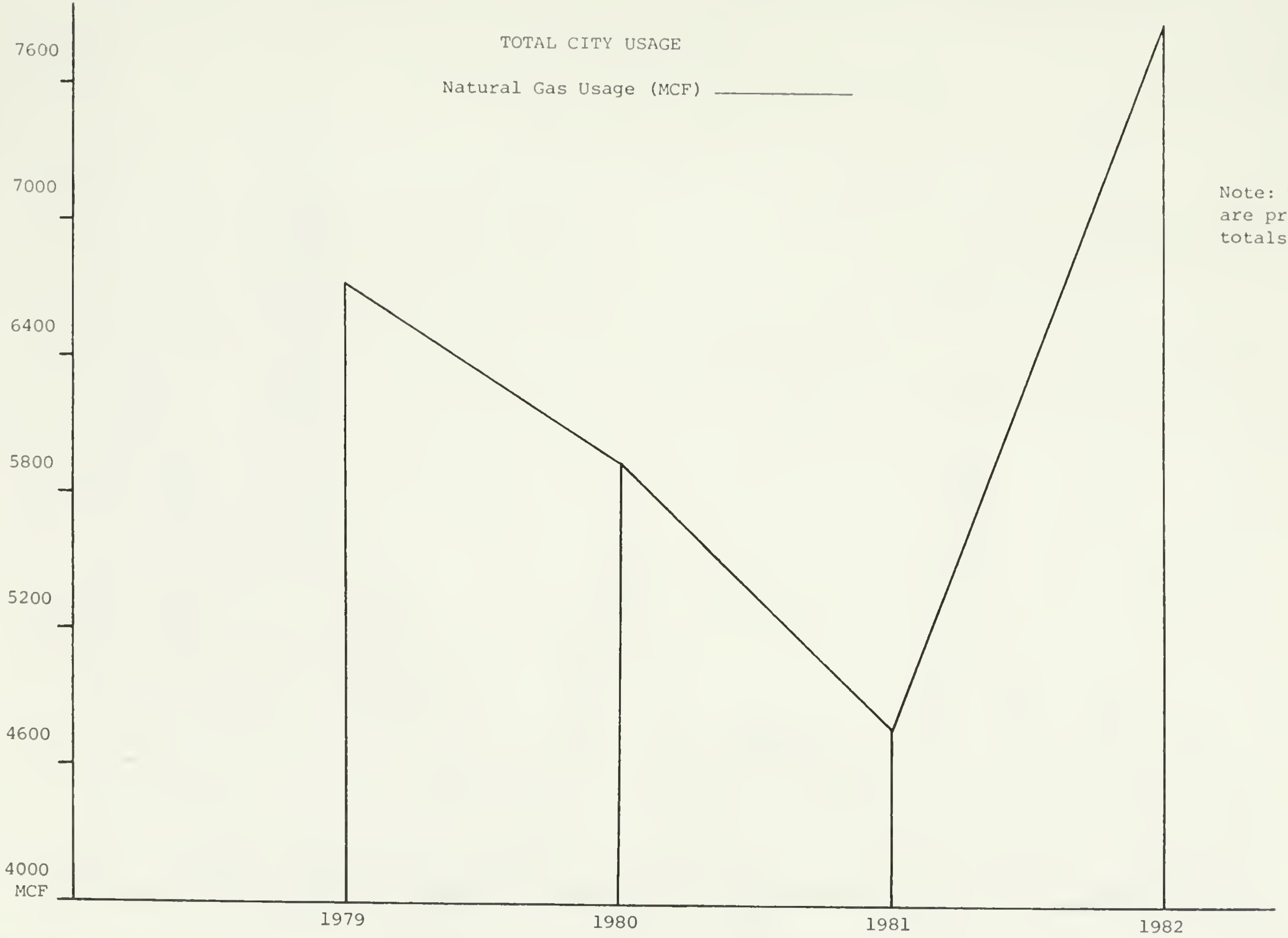
	[illegible]	[illegible]	Unit Cost Average ($/gal)
1979	[illegible]	[illegible]	.757
1980	[illegible]	[illegible]	1.123
1981	[illegible]	[illegible]	1.229
1982	[illegible]	[illegible]	1.150



TOTAL CITY USAGE



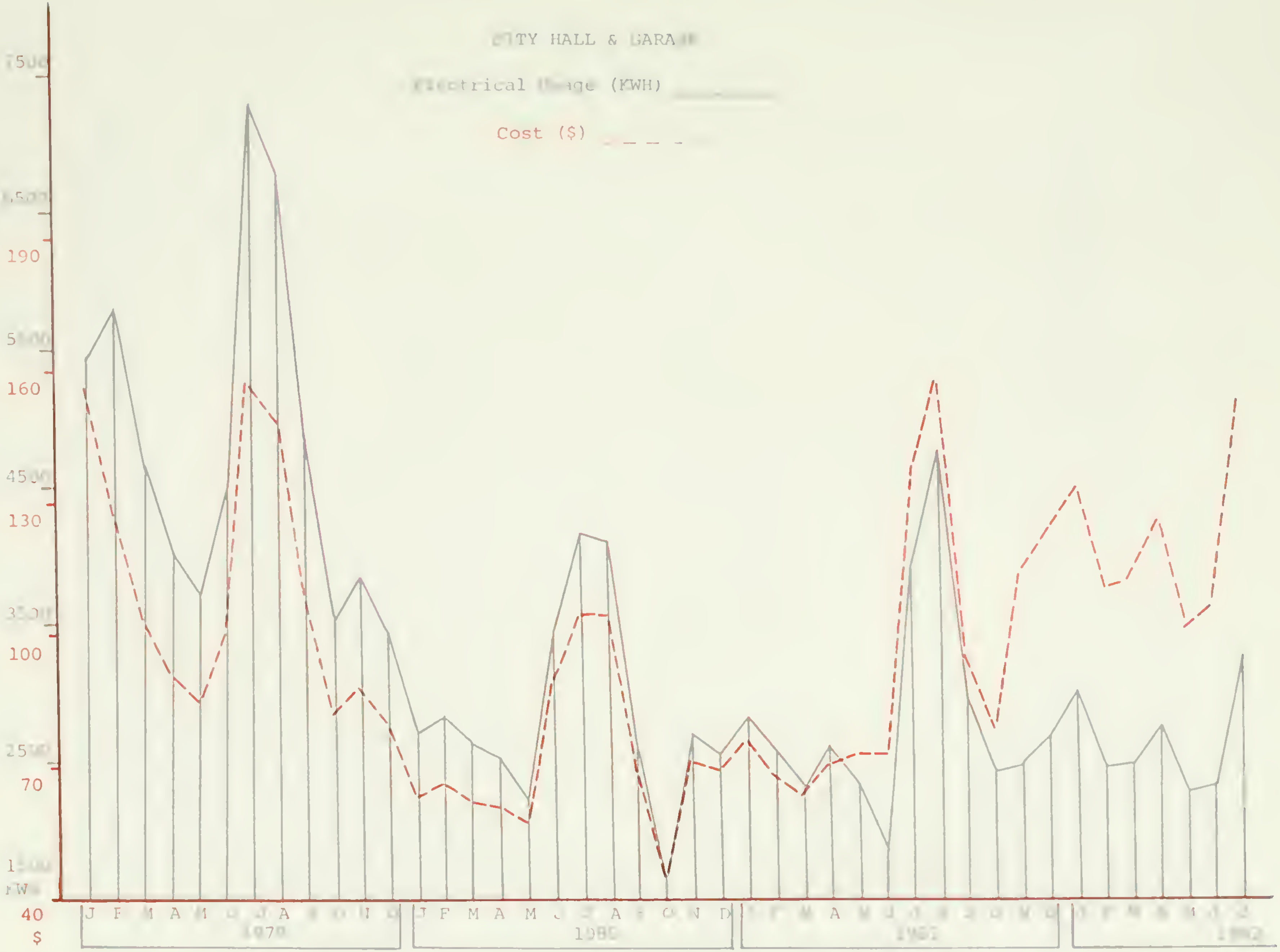

TOTAL CPU USAGE
Cost ($)
Note: Totals
are projected
totals (1982)
7600
37,000
7000
32,500
6400
28,000
5800
23,500
5200
19,000
4600
14,500
4000
NCF
10,000
$
1979
1980
1981
1982

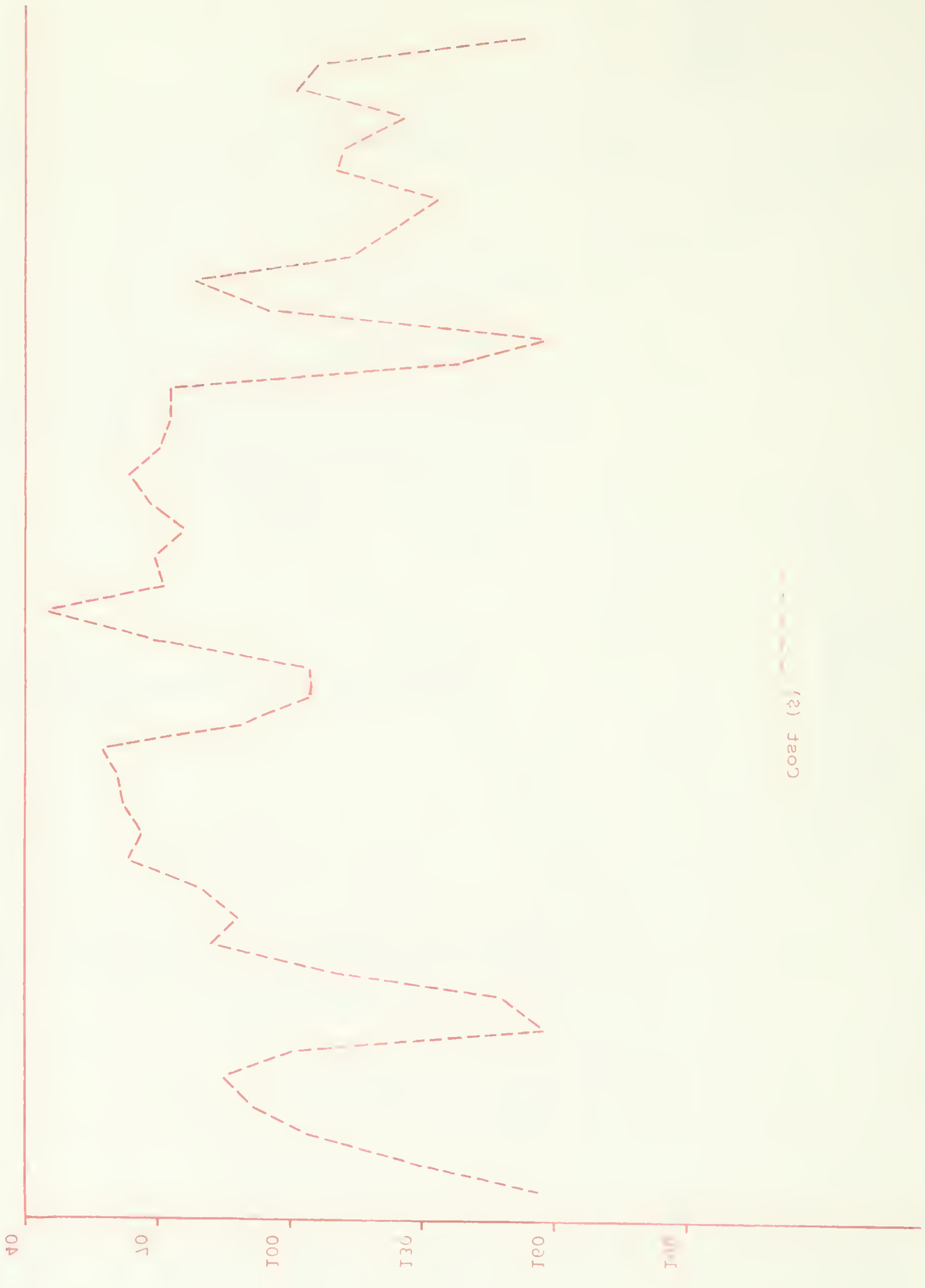


TOTAL CITY USAGE

Note: Totals are projected totals (1982)

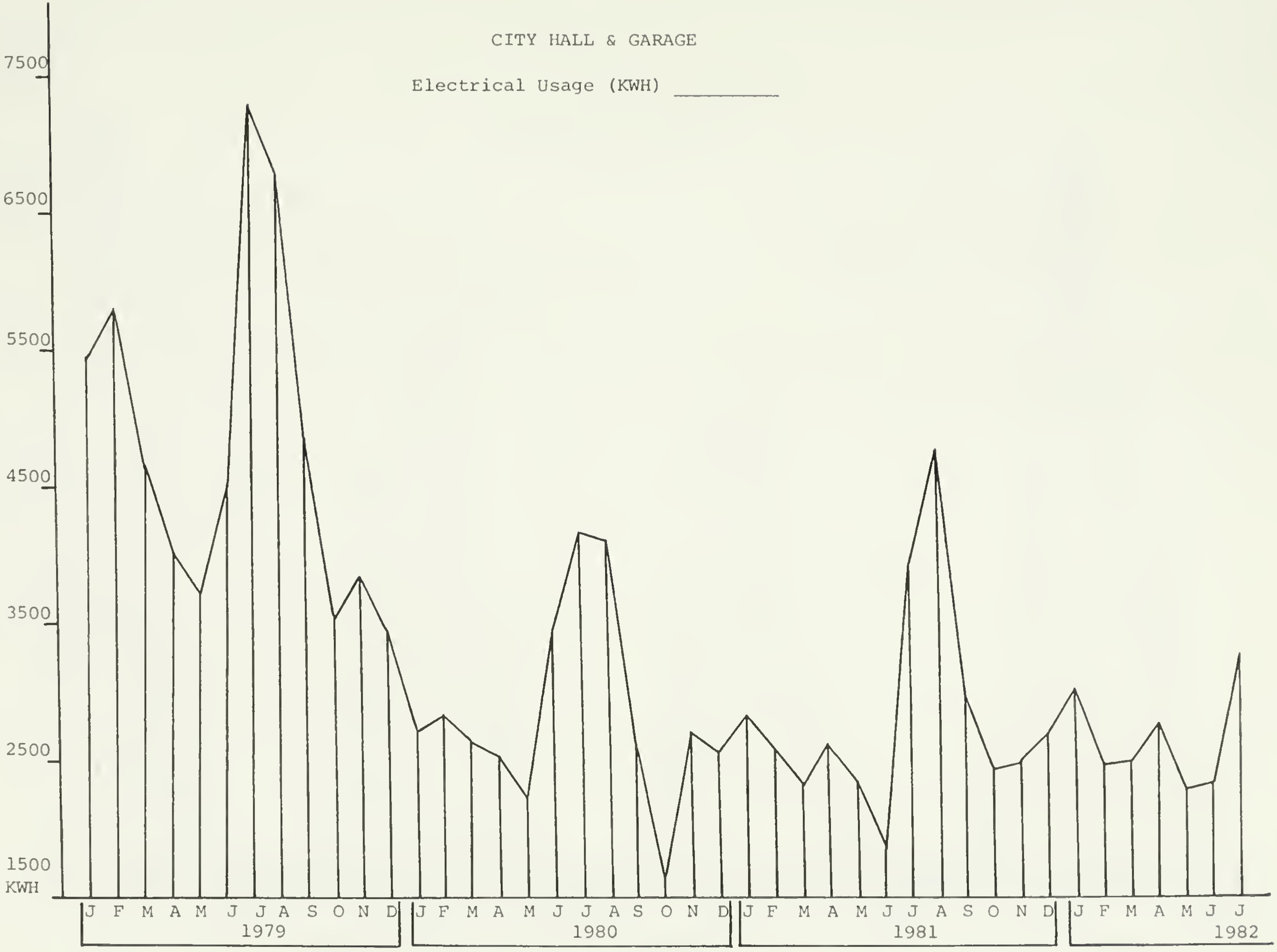
CITY HALL & GARAGE

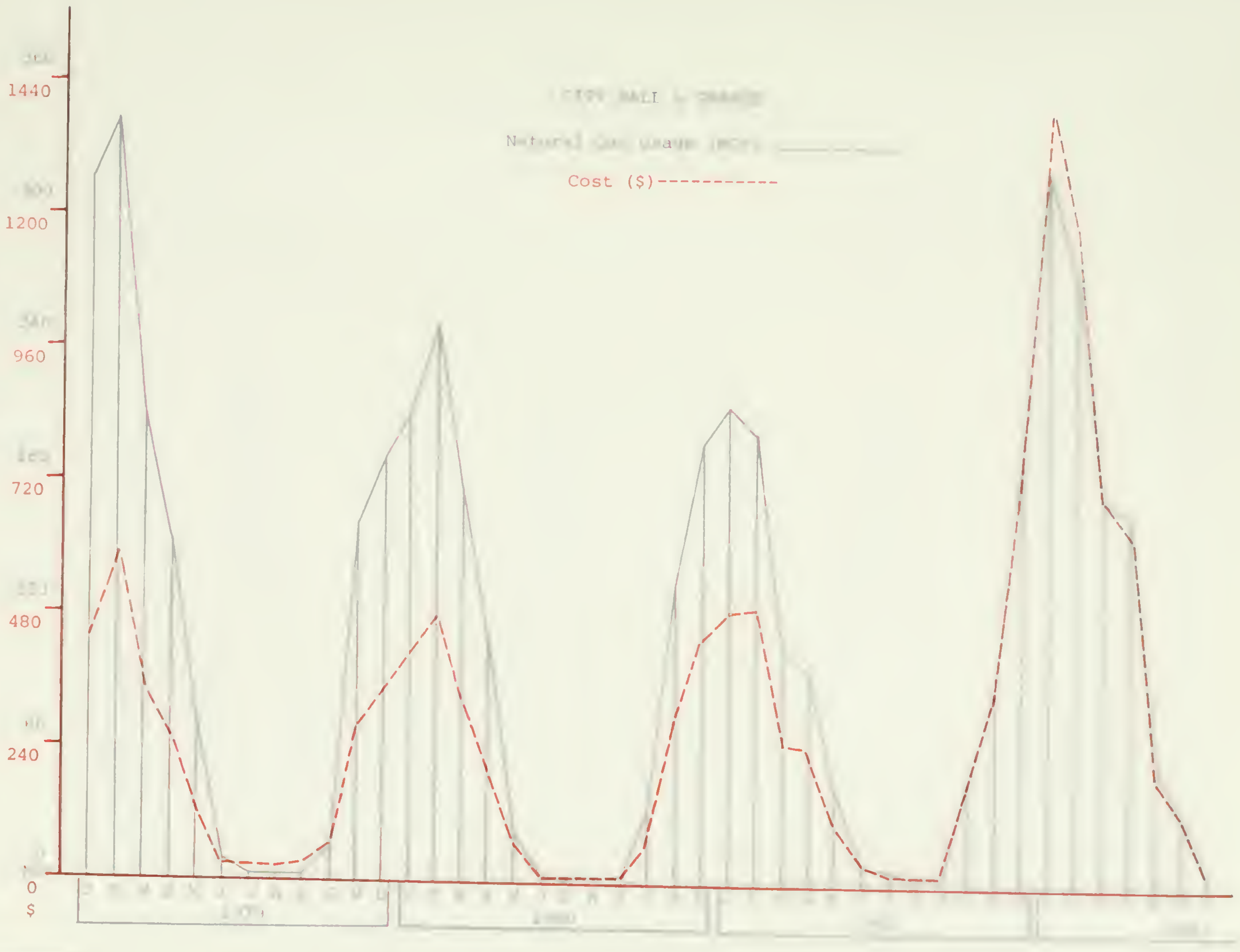


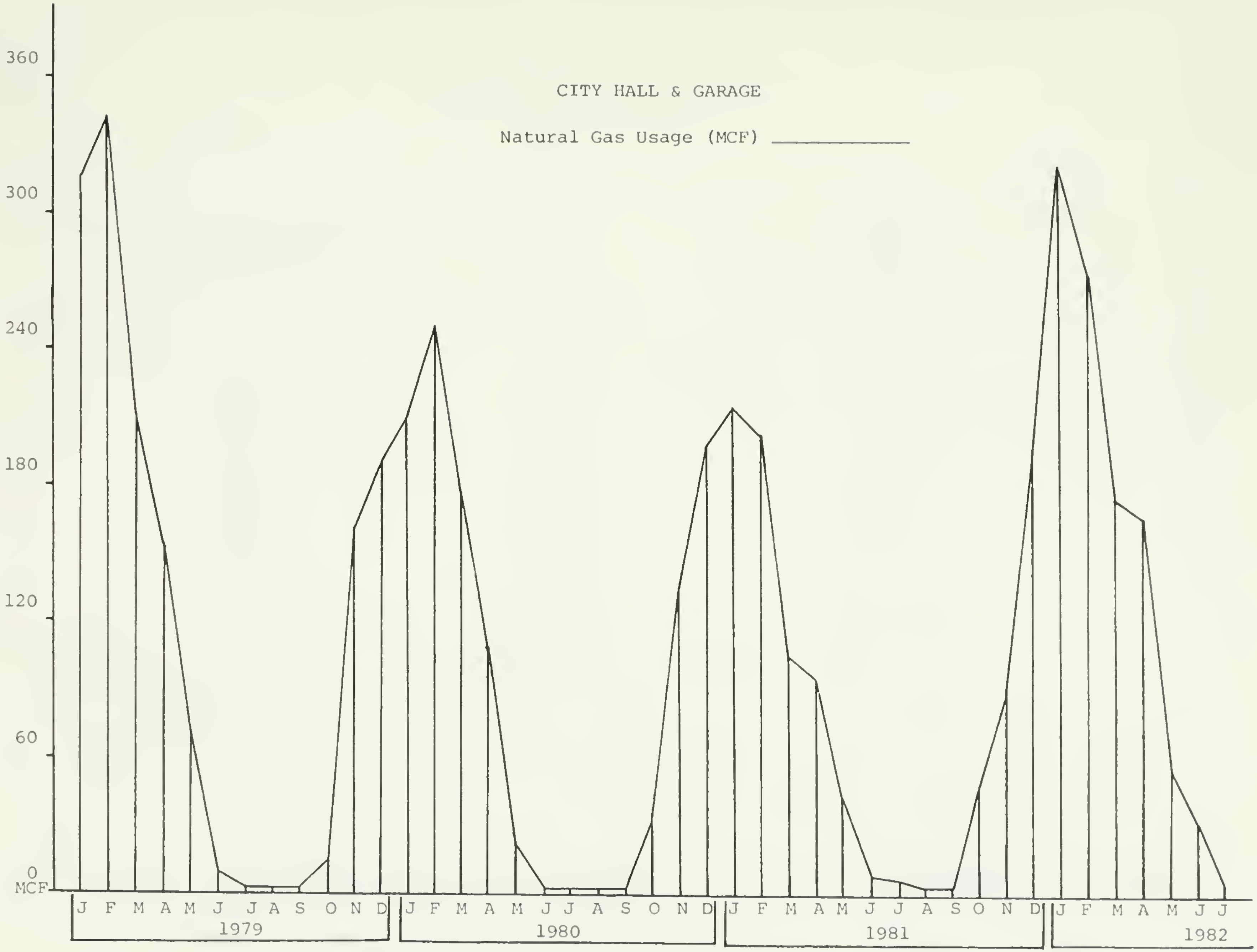

Cost ($)
40
70
100
130
160

CITY HALL & GARAGE

Electrical Usage (KWH) ________

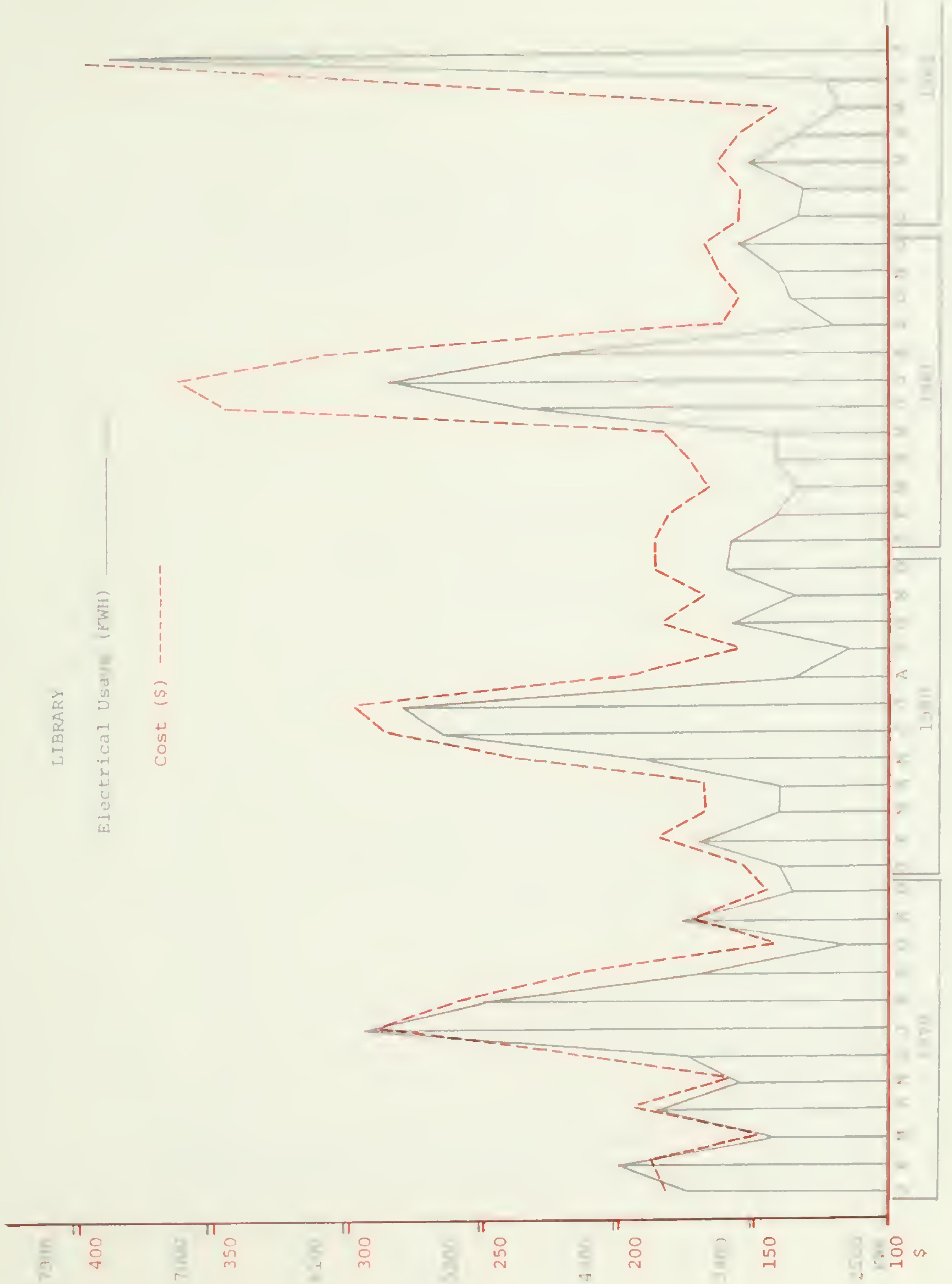


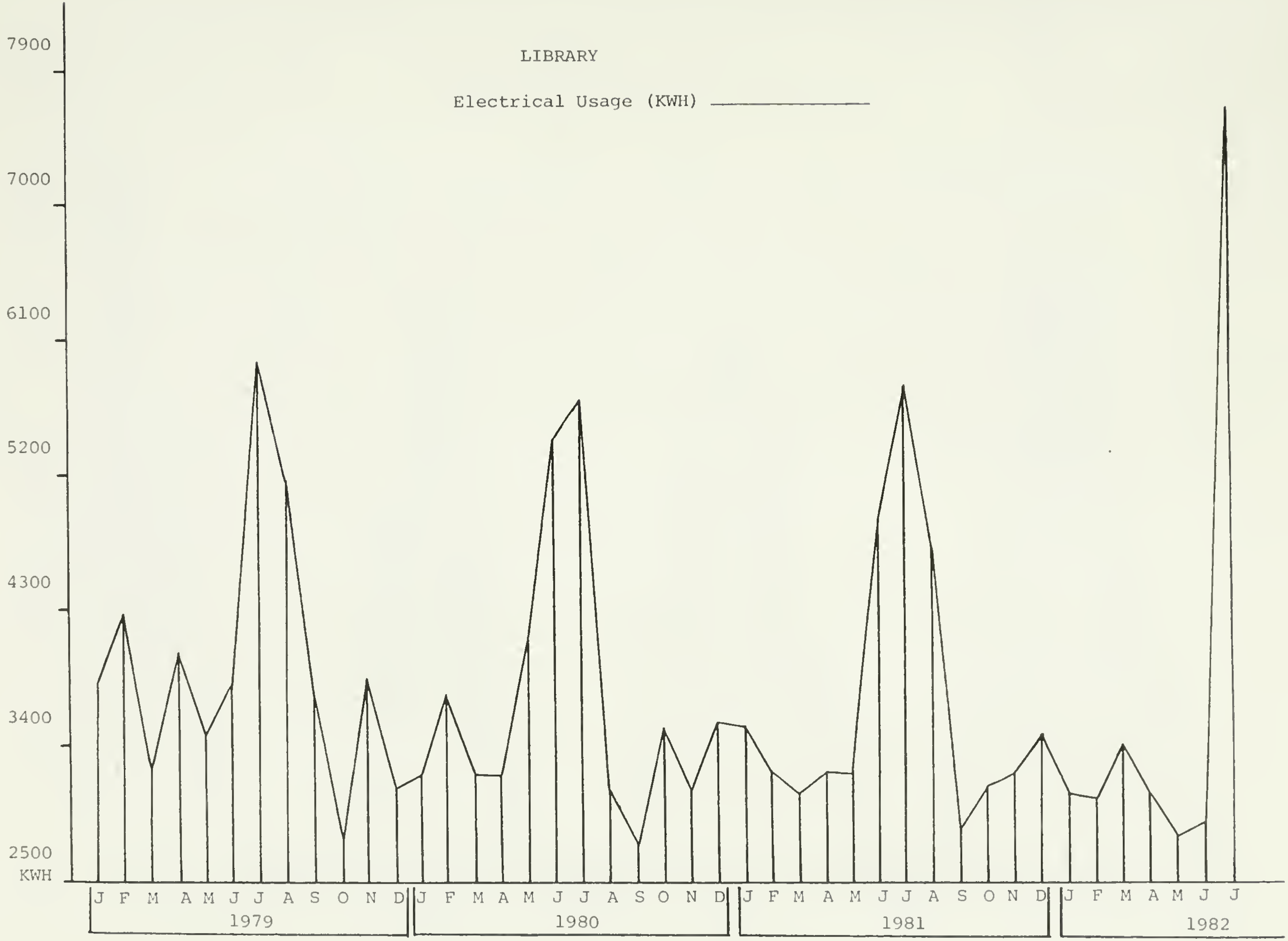

Natural Gas Usage (MCF)
Cost ($)
1440
1200
960
720
480
240
0
$



CITY HALL & GARAGE

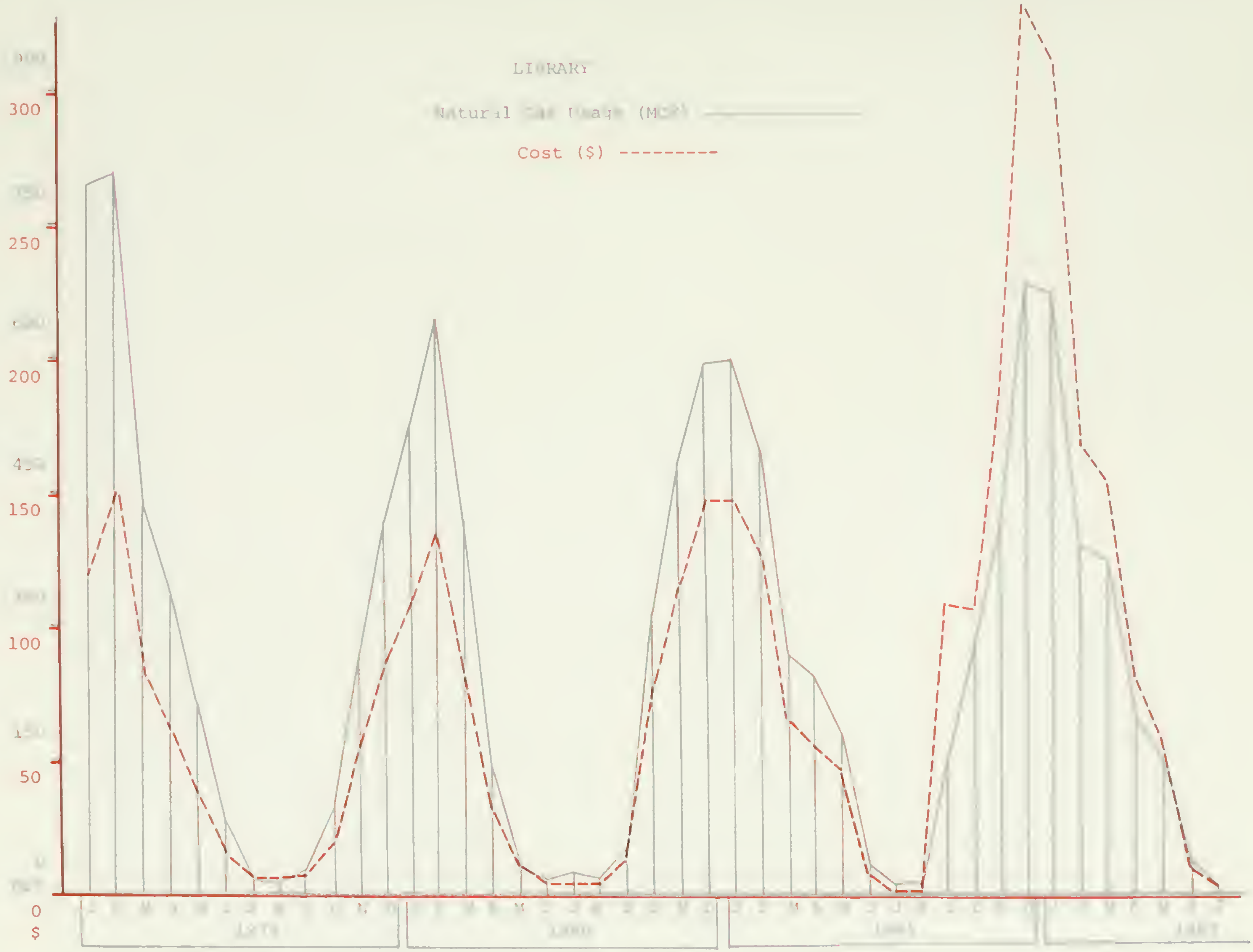
Natural Gas Usage (MCF)

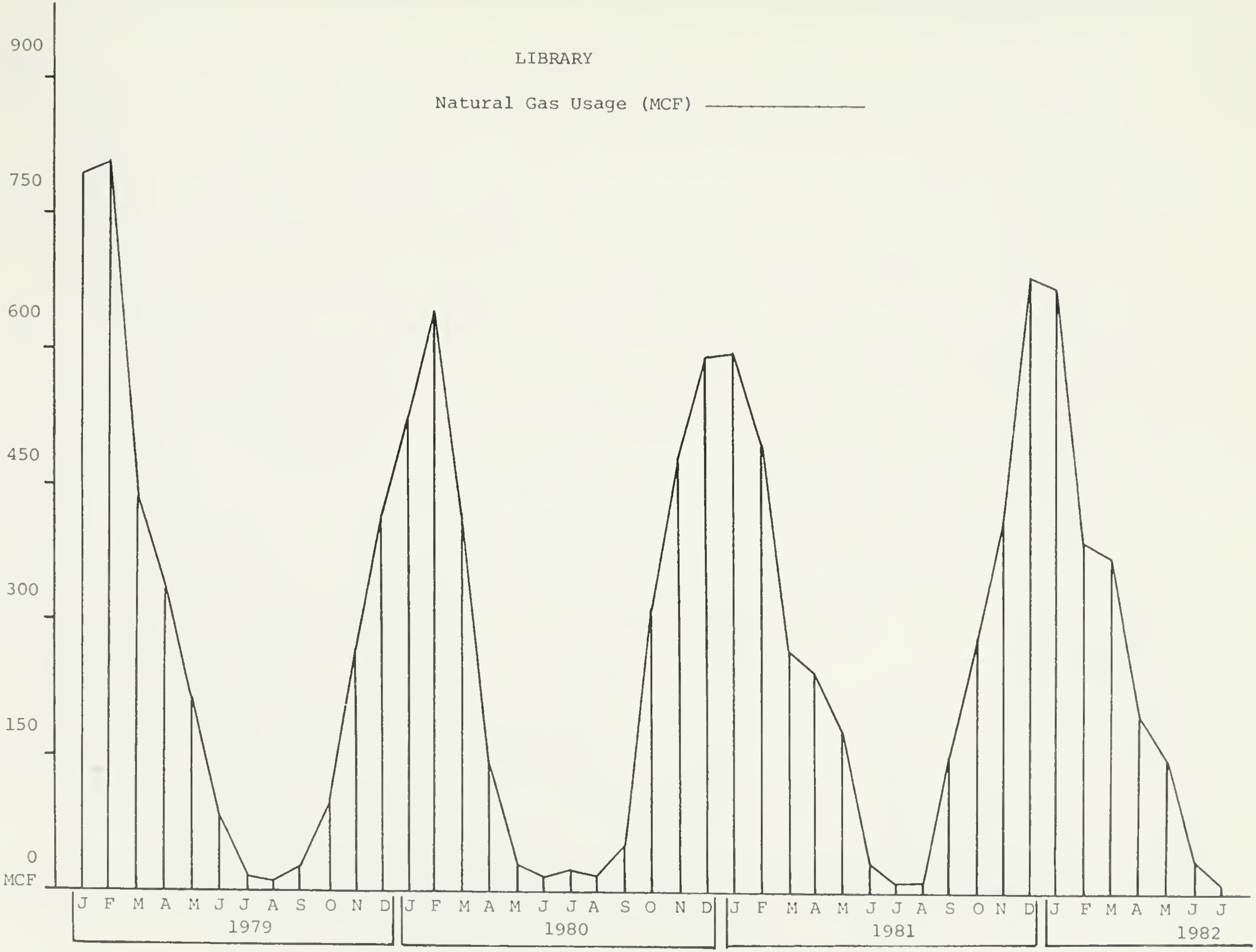

LIBRARY
Electrical Usage (KWH)
Cost ($)
400
350
300
250
200
150
100
$
4000
3000
1979
1980
1981
1982



LIBRARY

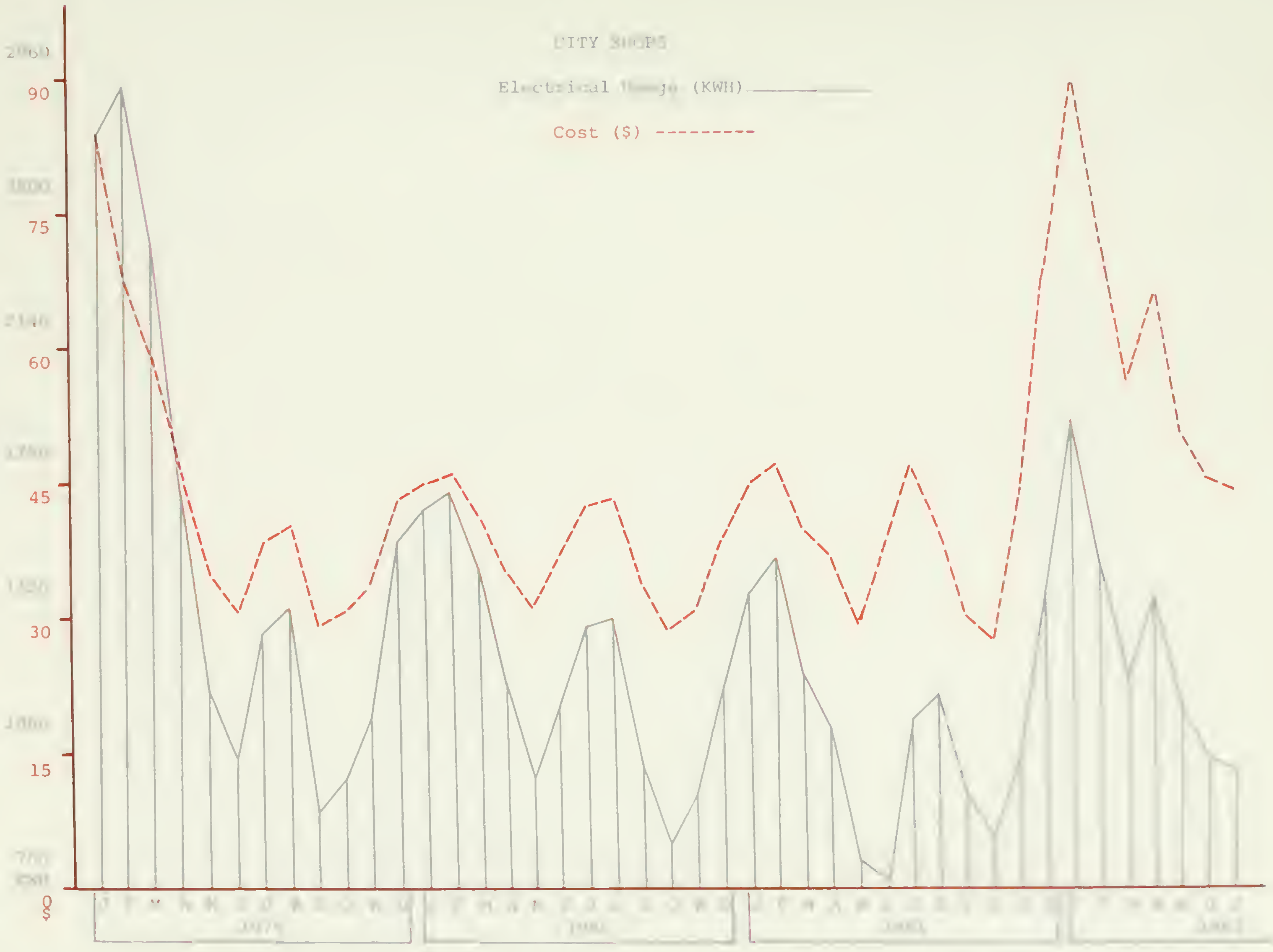
Electrical Usage (KWH)

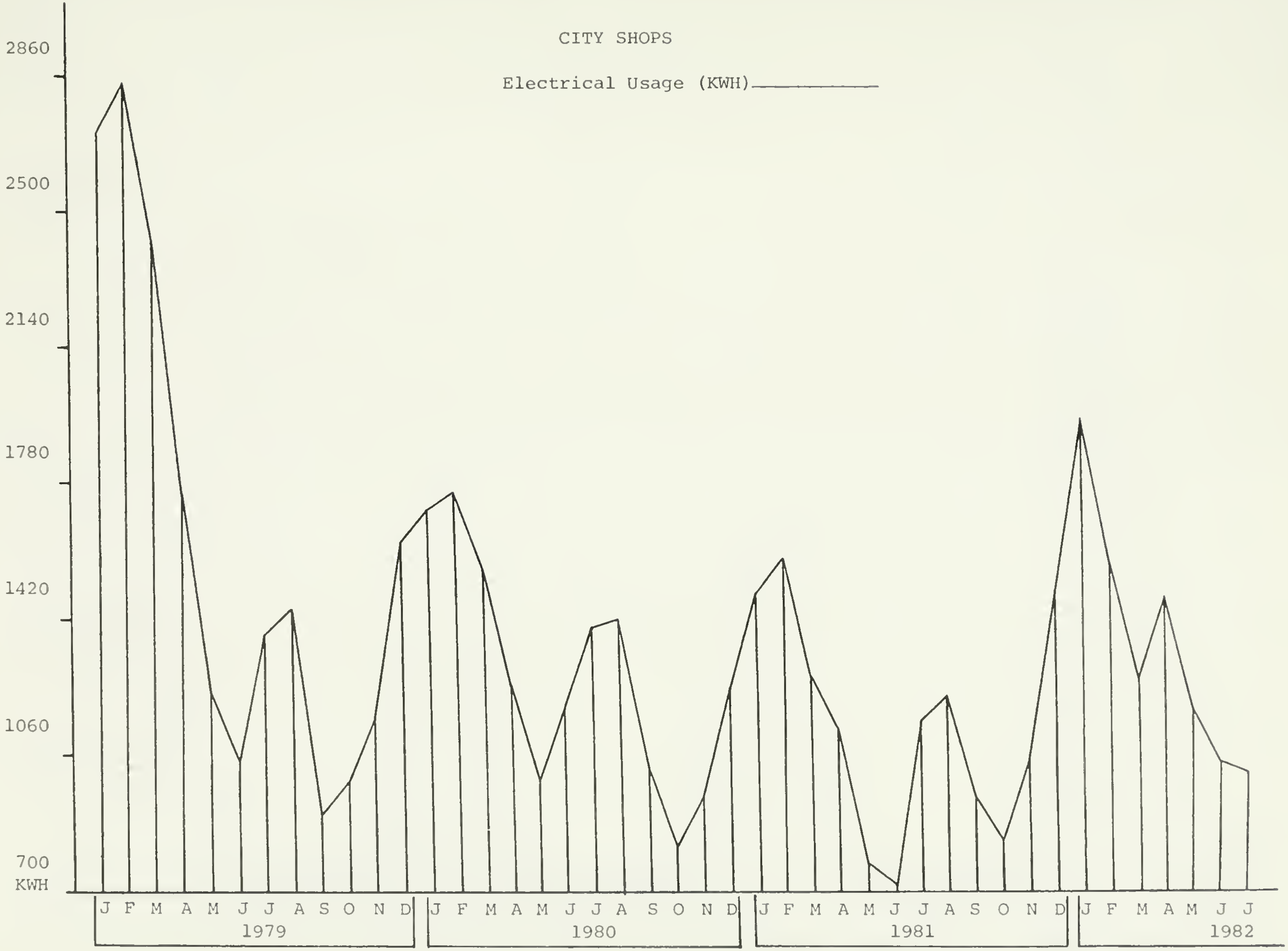

LIBRARY
Natural Gas Usage (MCF)
Cost ($)
300
250
200
150
100
50
0
$
MCF
1979
1980
1981
1982



LIBRARY

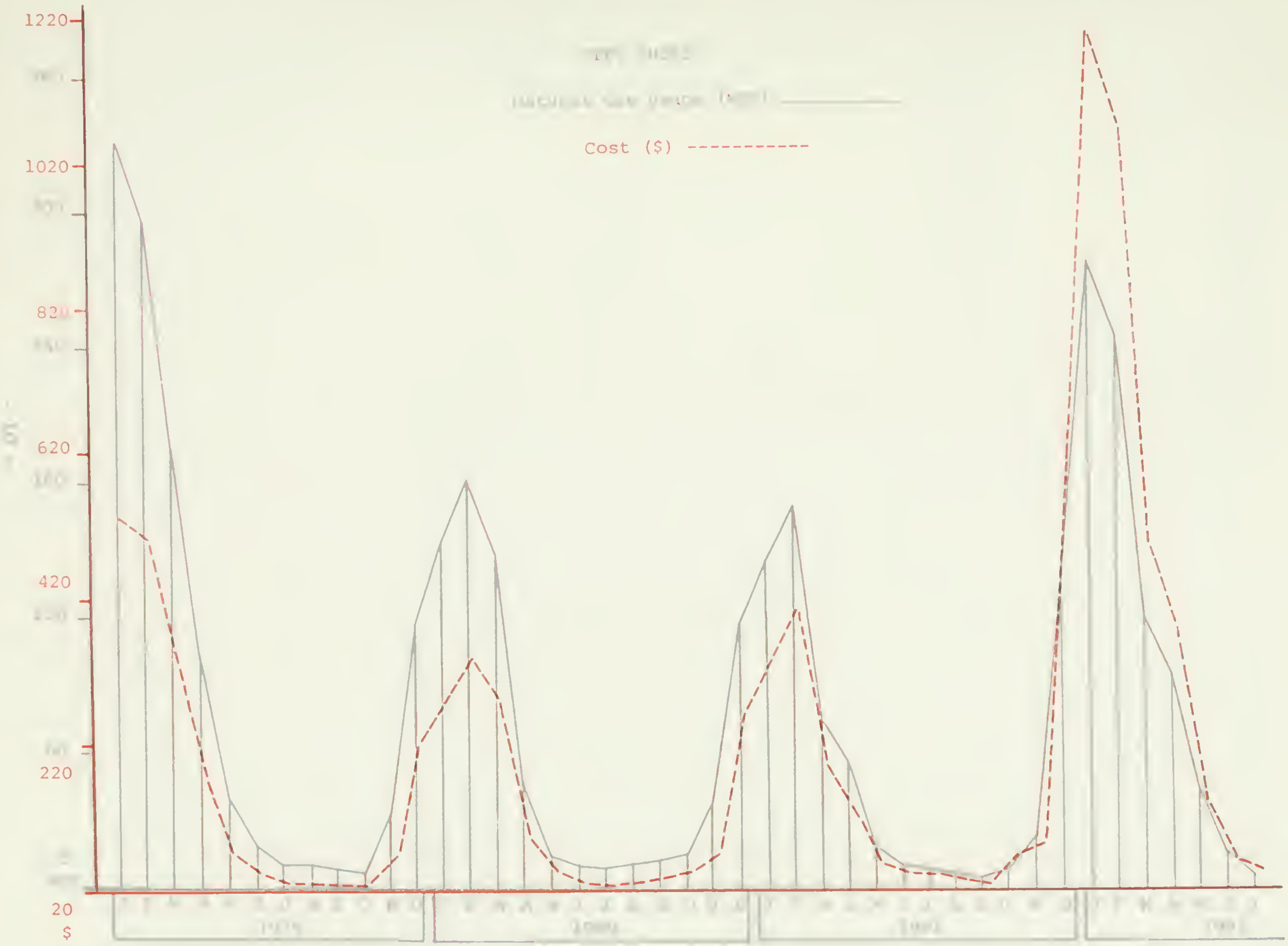
Natural Gas Usage (MCF)

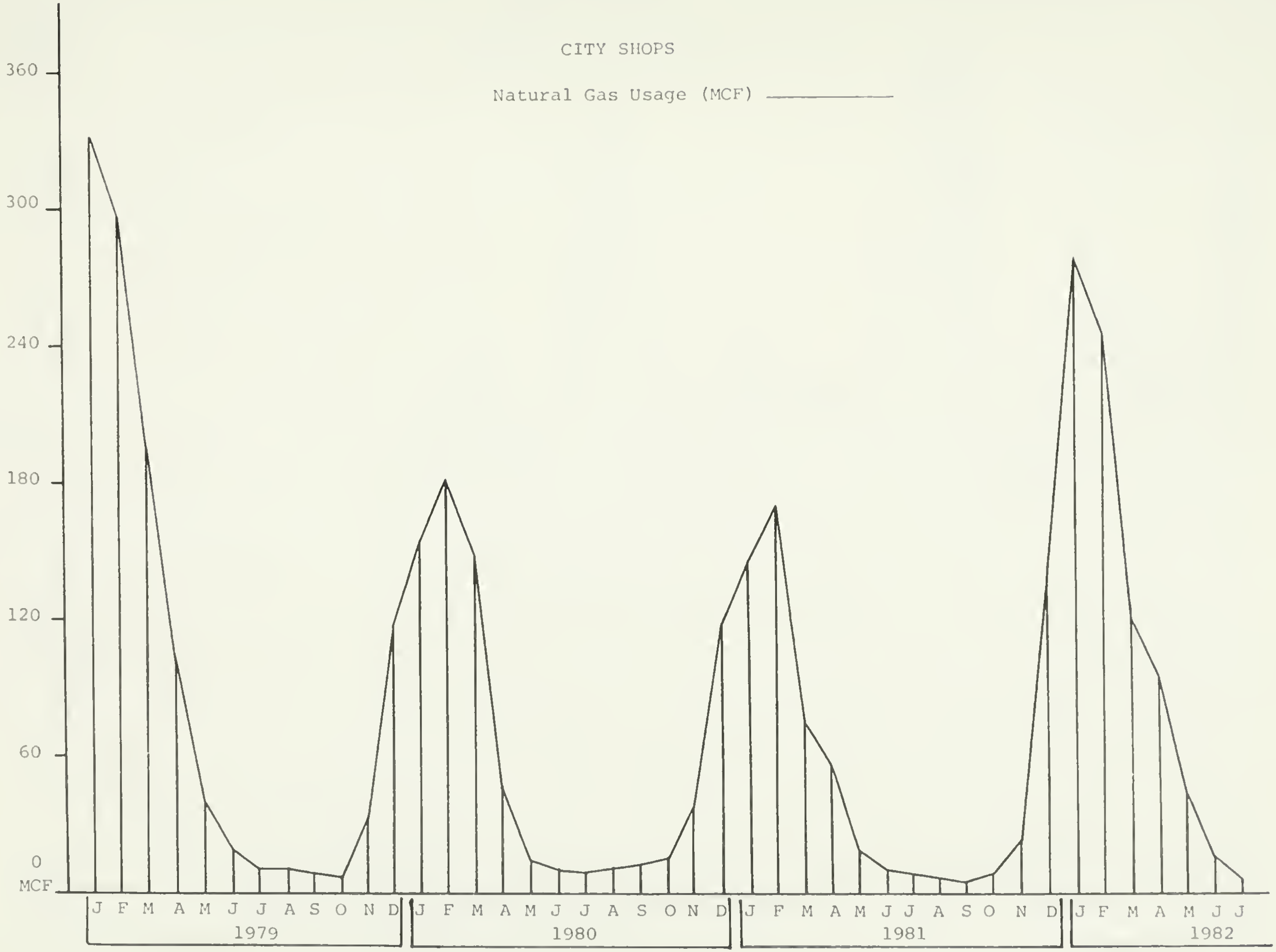

CITY SHOPS
Electrical Usage (KWH)
Cost ($)
90
75
60
45
30
15
0
$

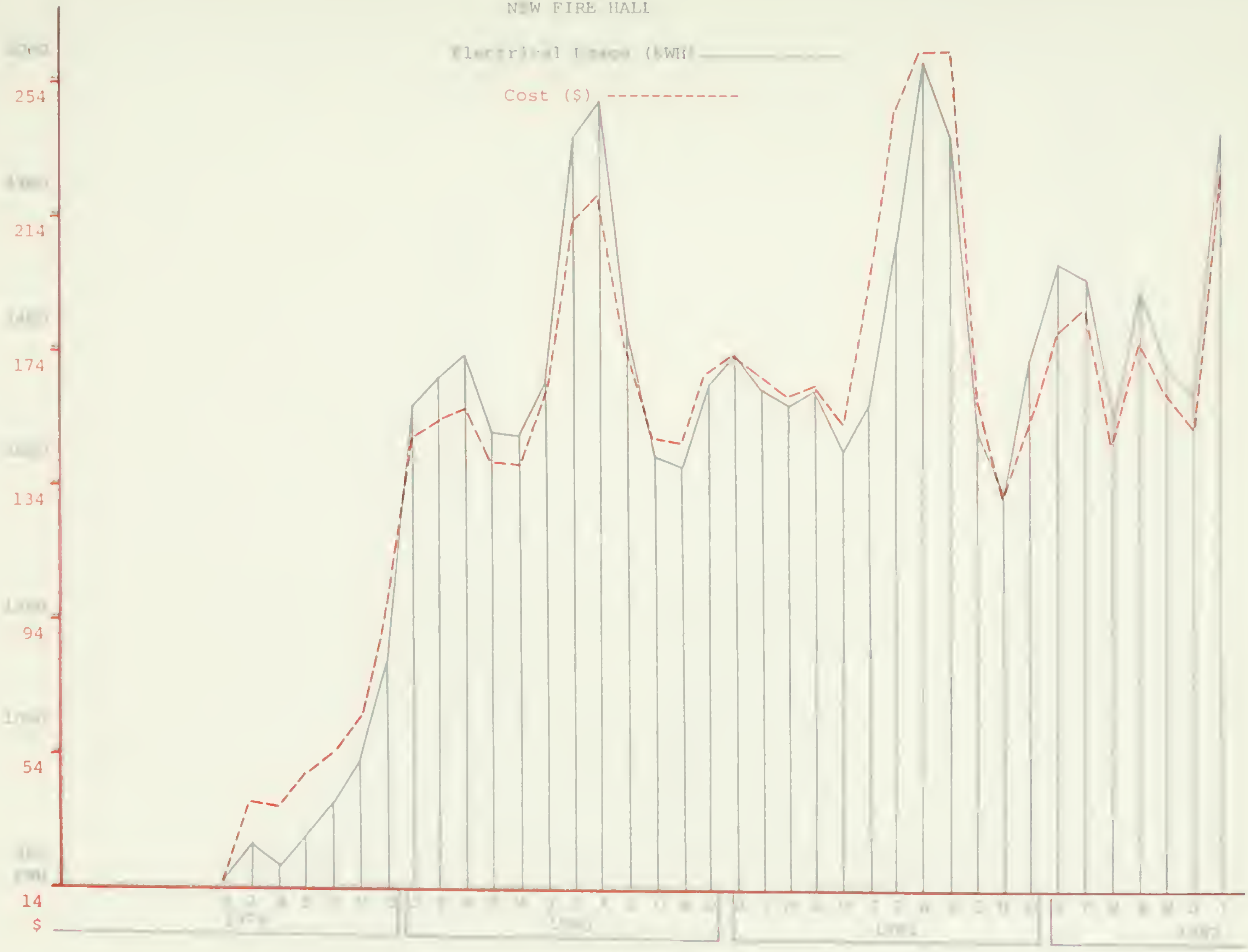


CITY SHOPS

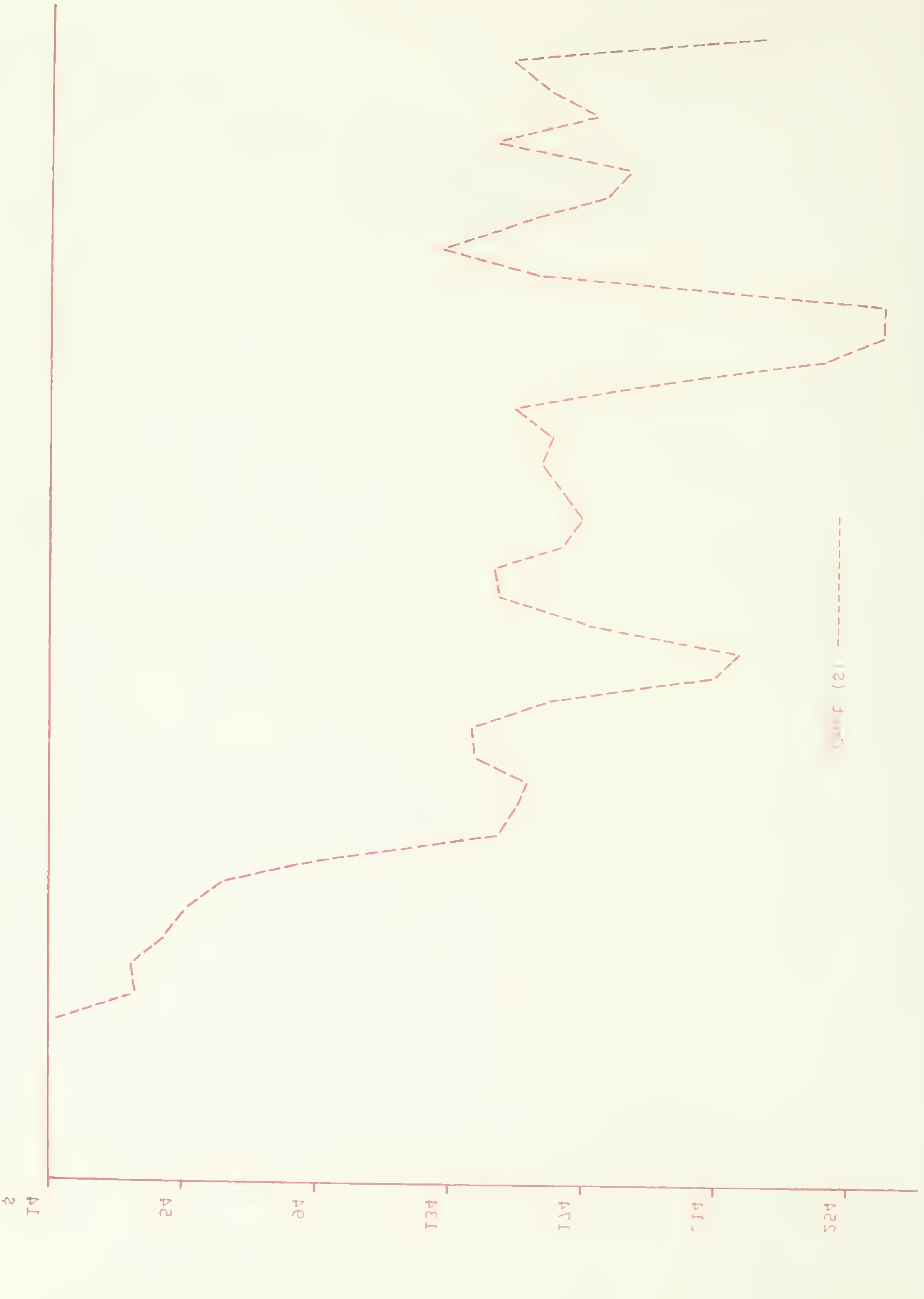
Electrical Usage (KWH)


Cost ($)
1220
1020
820
620
420
220
20
$

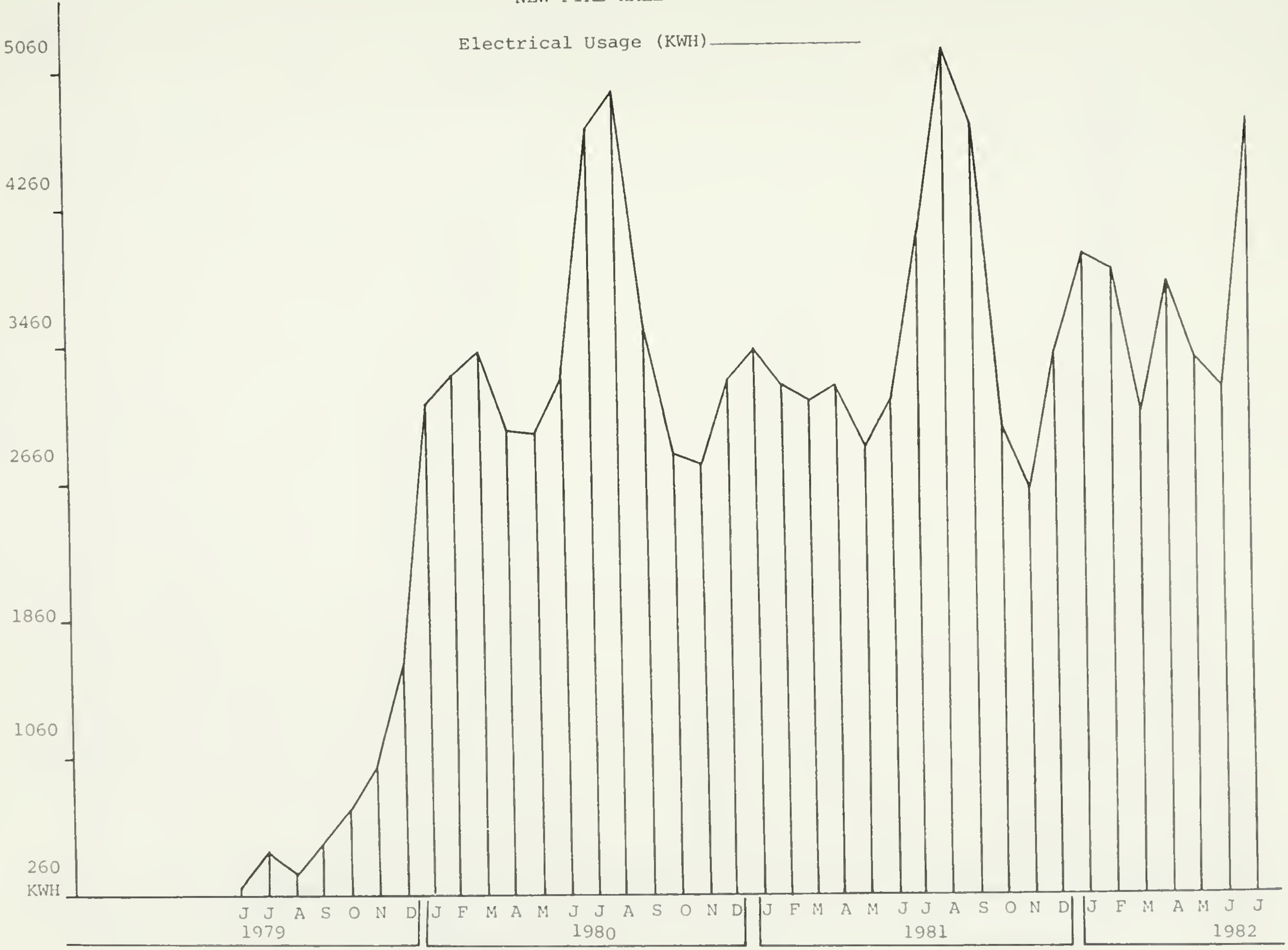

CITY SHOPS
Natural Gas Usage (MCF)
360
300
240
180
120
60
0
MCF
J F M A M J J A S O N D
1979
J F M A M J J A S O N D
1980
J F M A M J J A S O N D
1981
J F M A M J J
1982

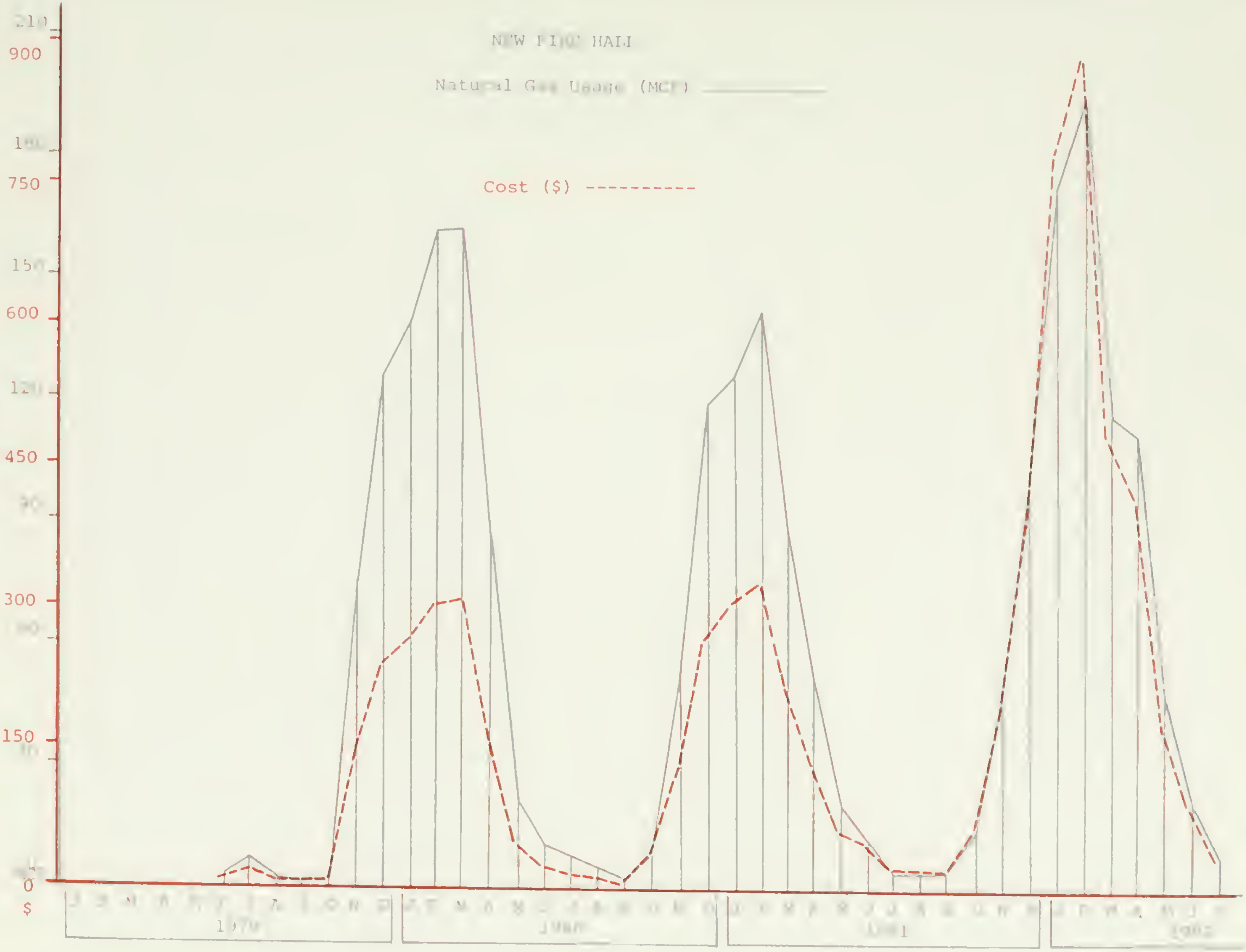


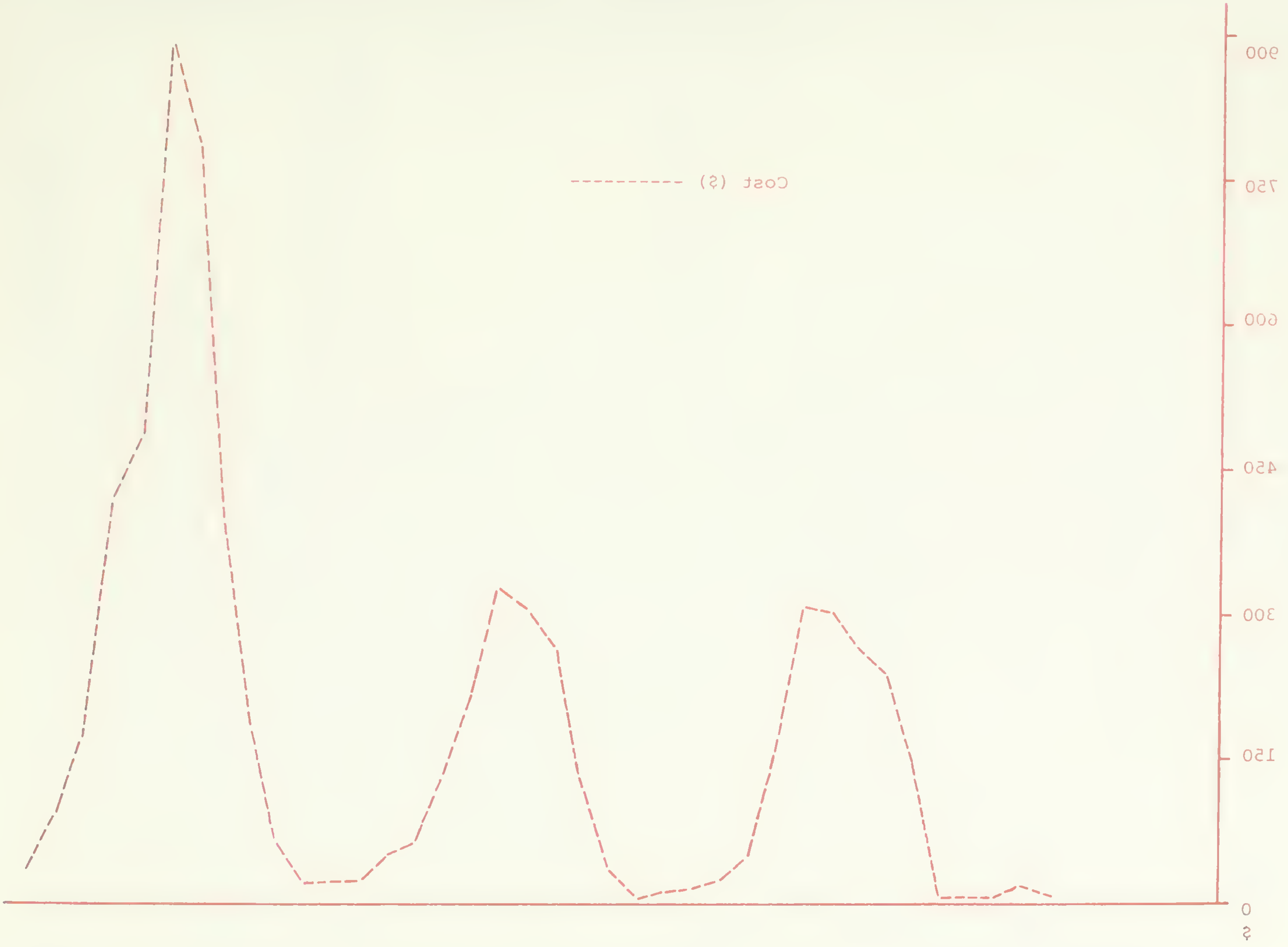
NEW FIRE HALL


s
14
54
94
134
174
214
254
(S)

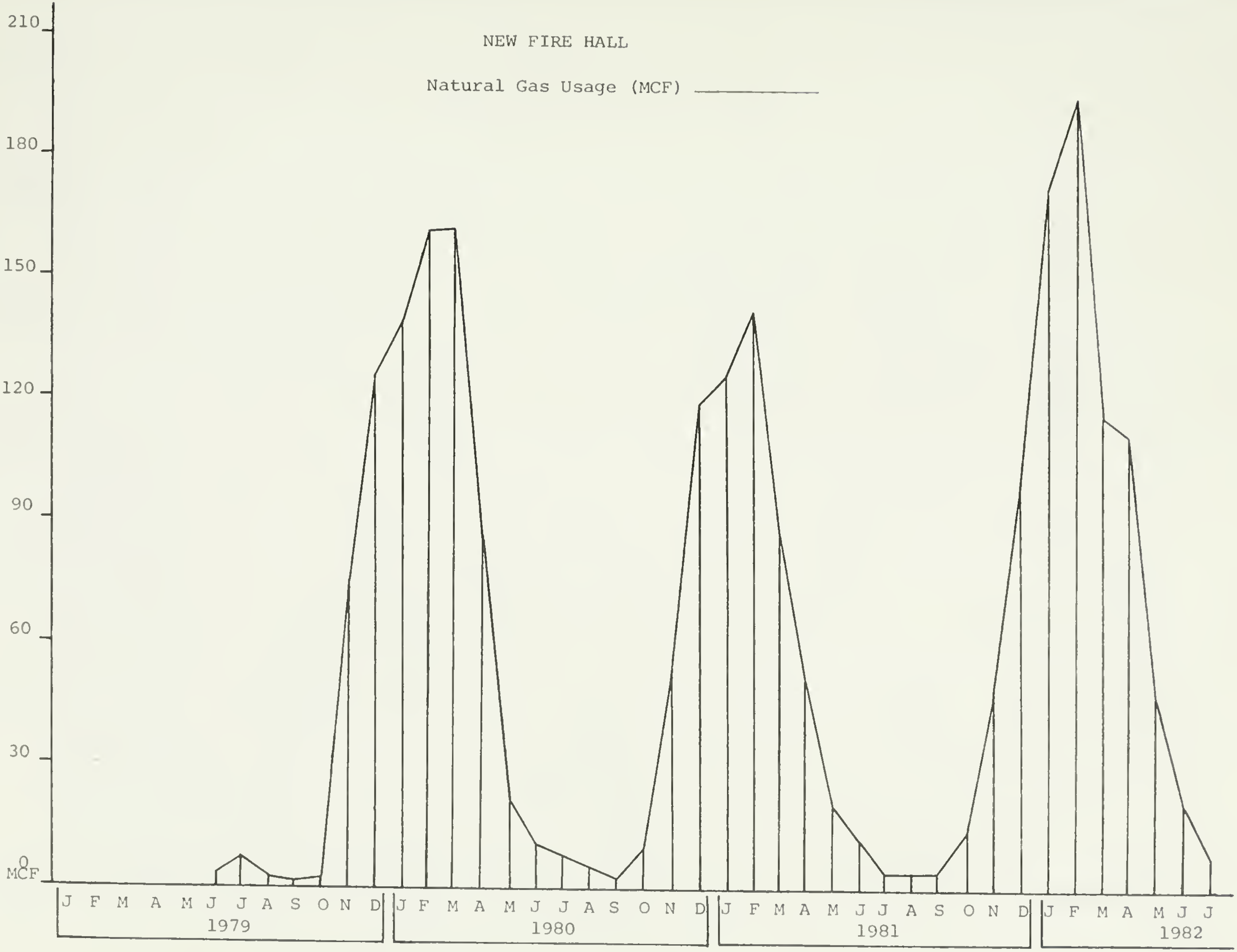
NEW FIRE HALL

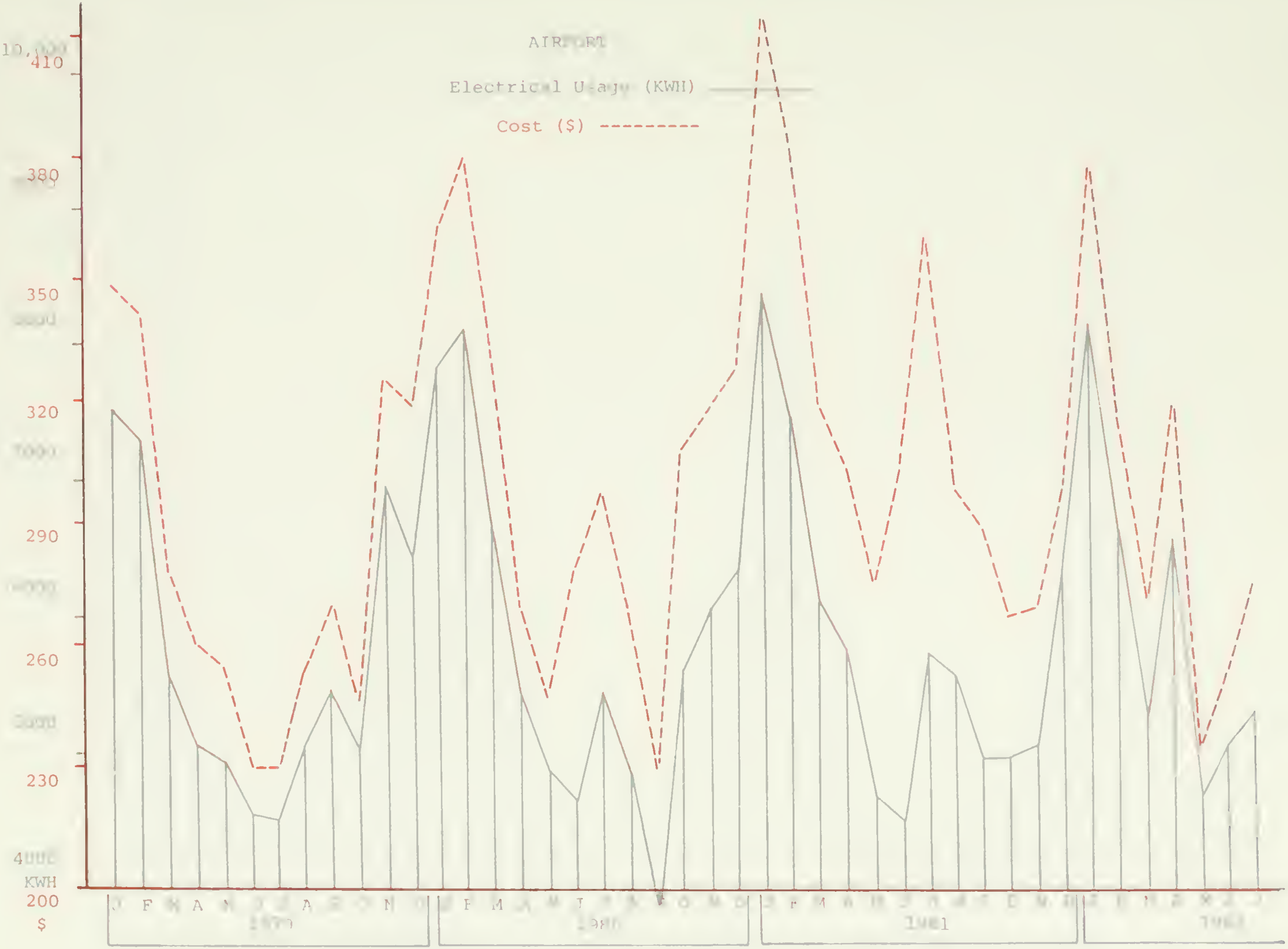


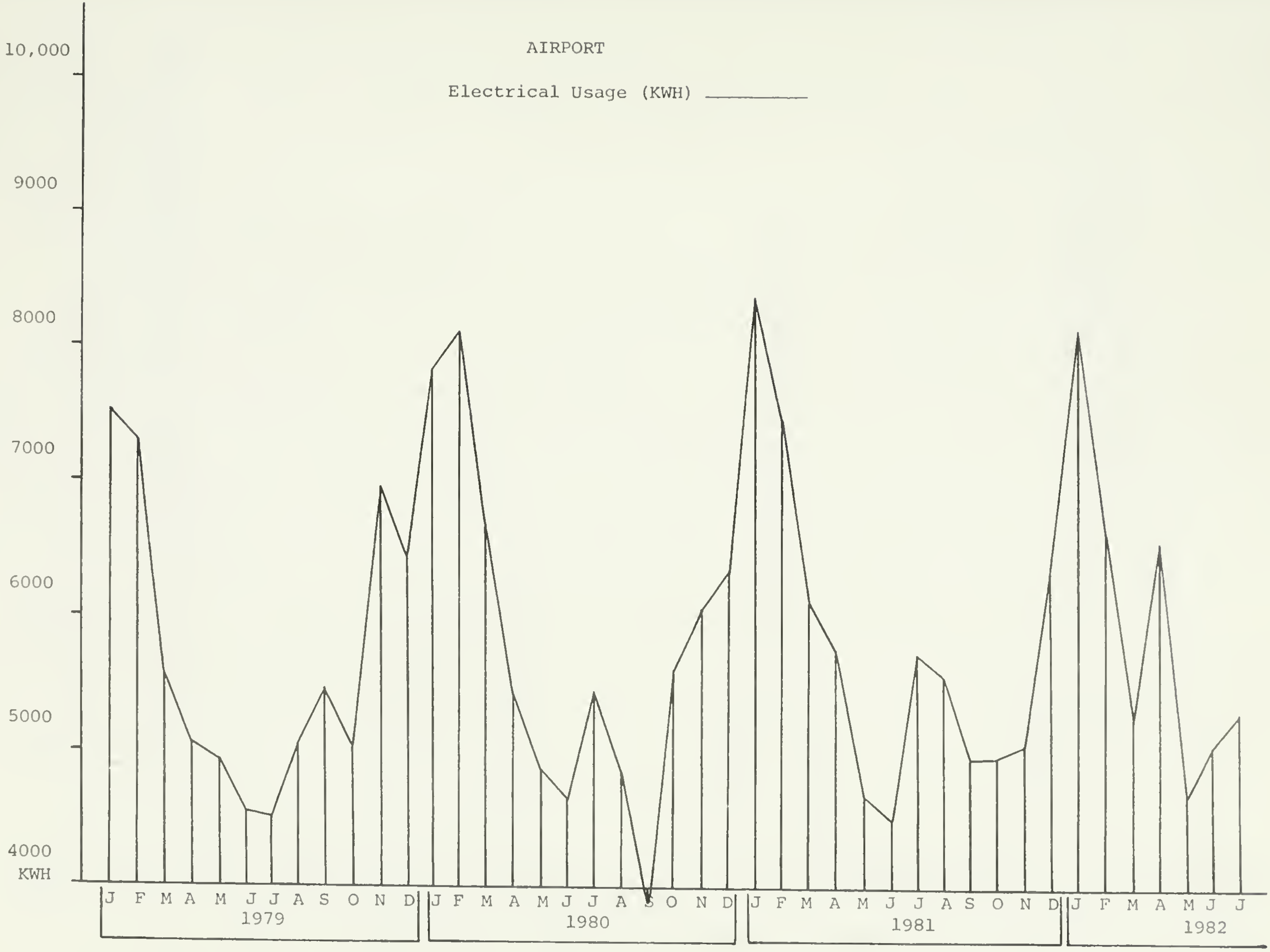

NEW FINE HALL
Natural Gas Usage (MCF)
Cost ($)
210
900
180
750
150
600
120
450
90
300
60
150
30
0
$
J F M A M J J A S O N D
1979
J F M A M J J A S O N D
1980
J F M A M J J A S O N D
1981
J F M A M J J
1982

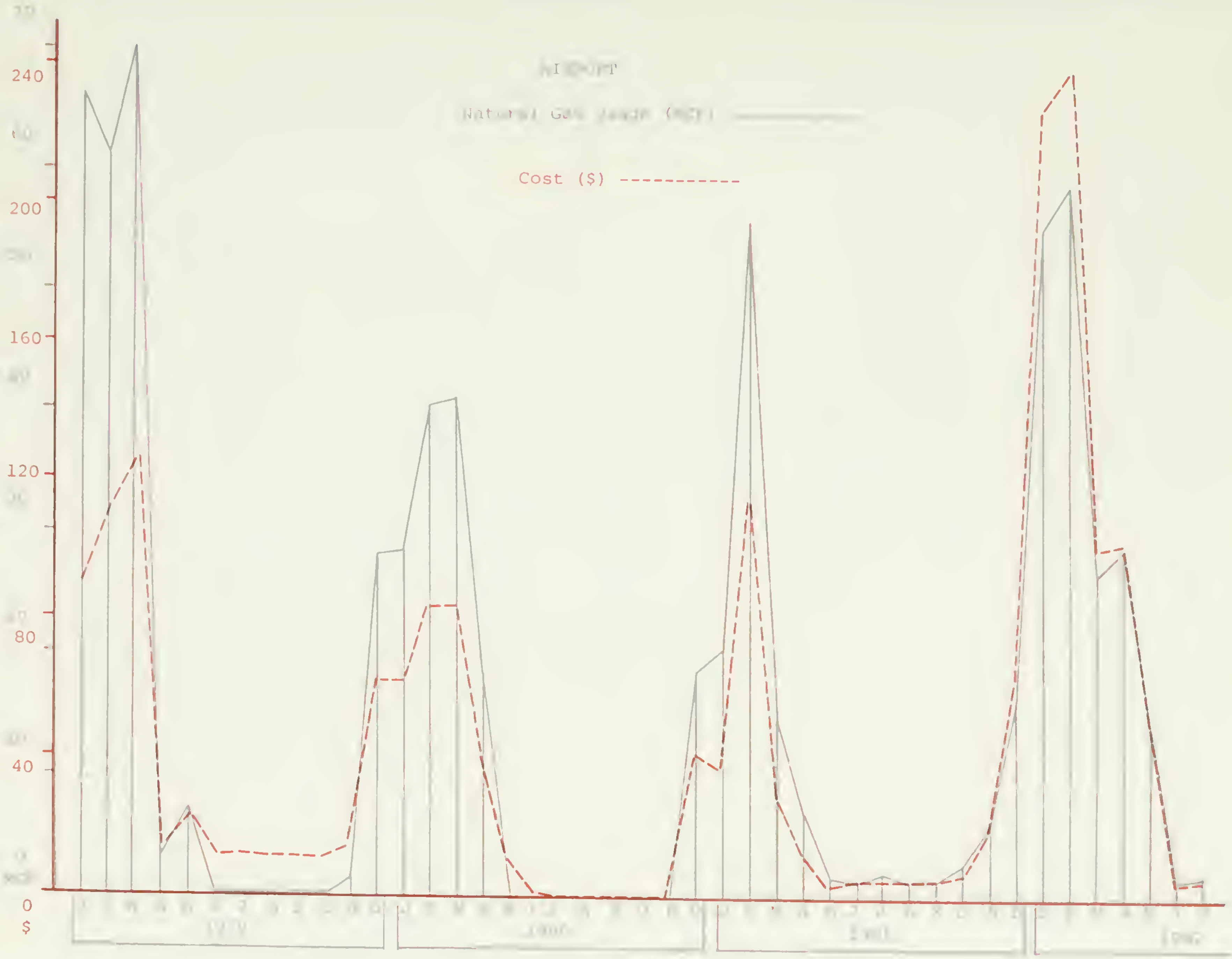

Cost ($)
$
0
150
300
450
600
750
900

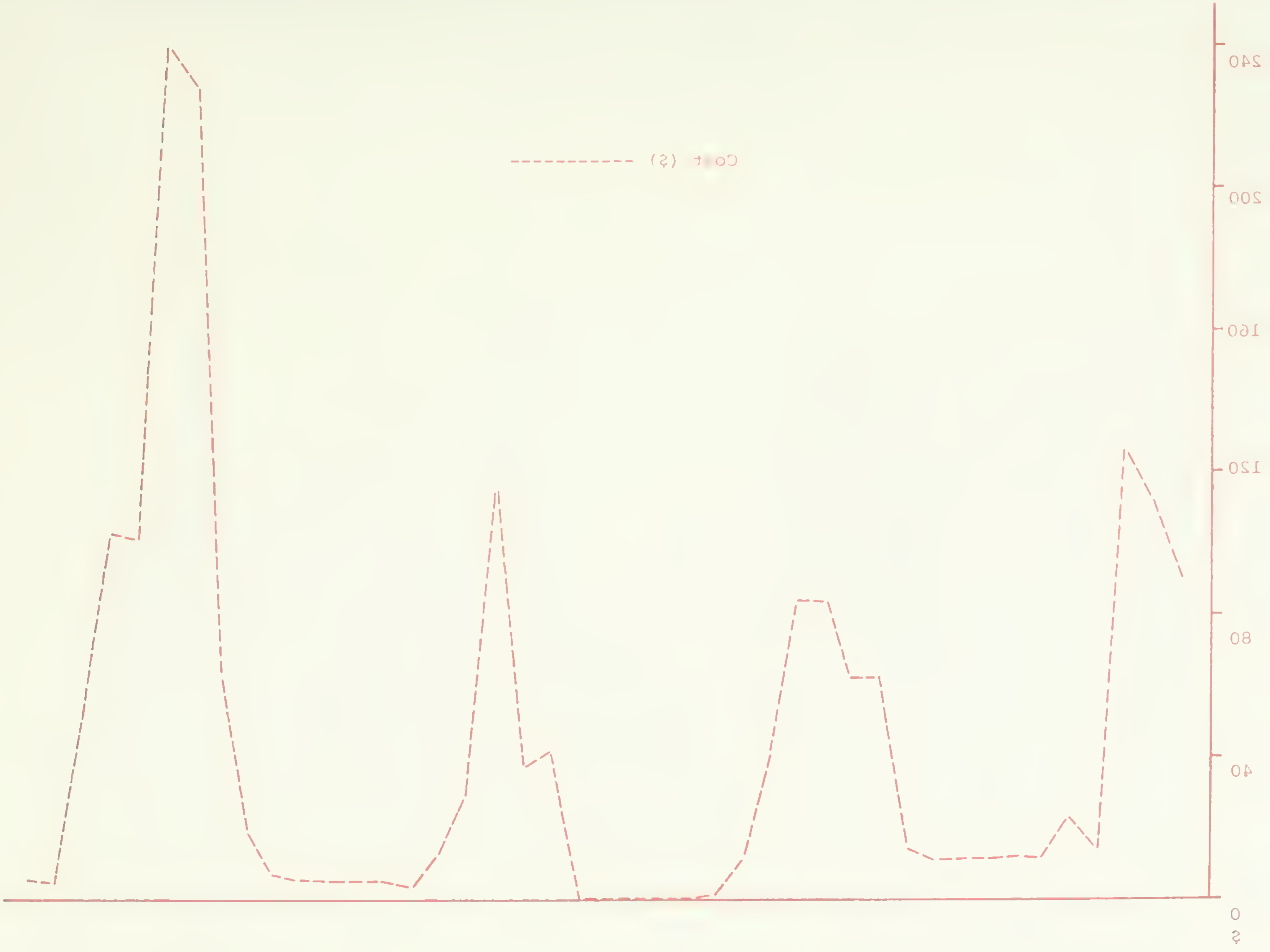
NEW FIRE HALL

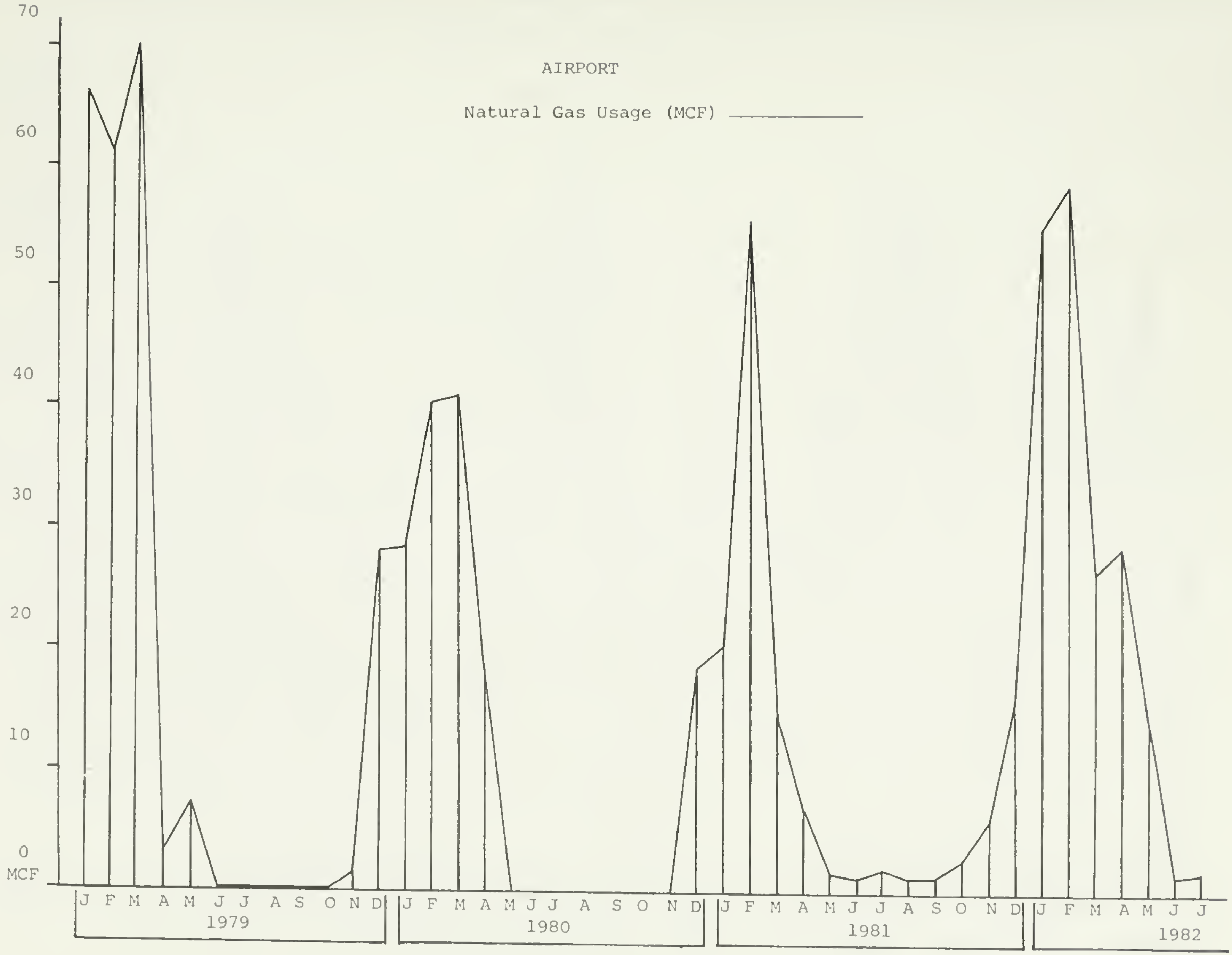



AIRPORT
Electrical Usage (KWH)
Cost ($)
10,000
410
380
9000
350
8000
320
7000
290
6000
260
5000
230
4000
KWH
200
$
J F M A M J J A S O N D
J F M A M J J A S O N D
J F M A M J J A S O N D
J F M A M J J
1979
1980
1981
1982


AIRPORT
Electrical Usage (KWH)
10,000
9000
8000
7000
6000
5000
4000
KWH
J F M A M J J A S O N D
1979
J F M A M J J A S O N D
1980
J F M A M J J A S O N D
1981
J F M A M J J
1982


AIRPORT
Natural Gas Usage (MCF)
Cost ($)
240
200
160
120
80
40
0
$

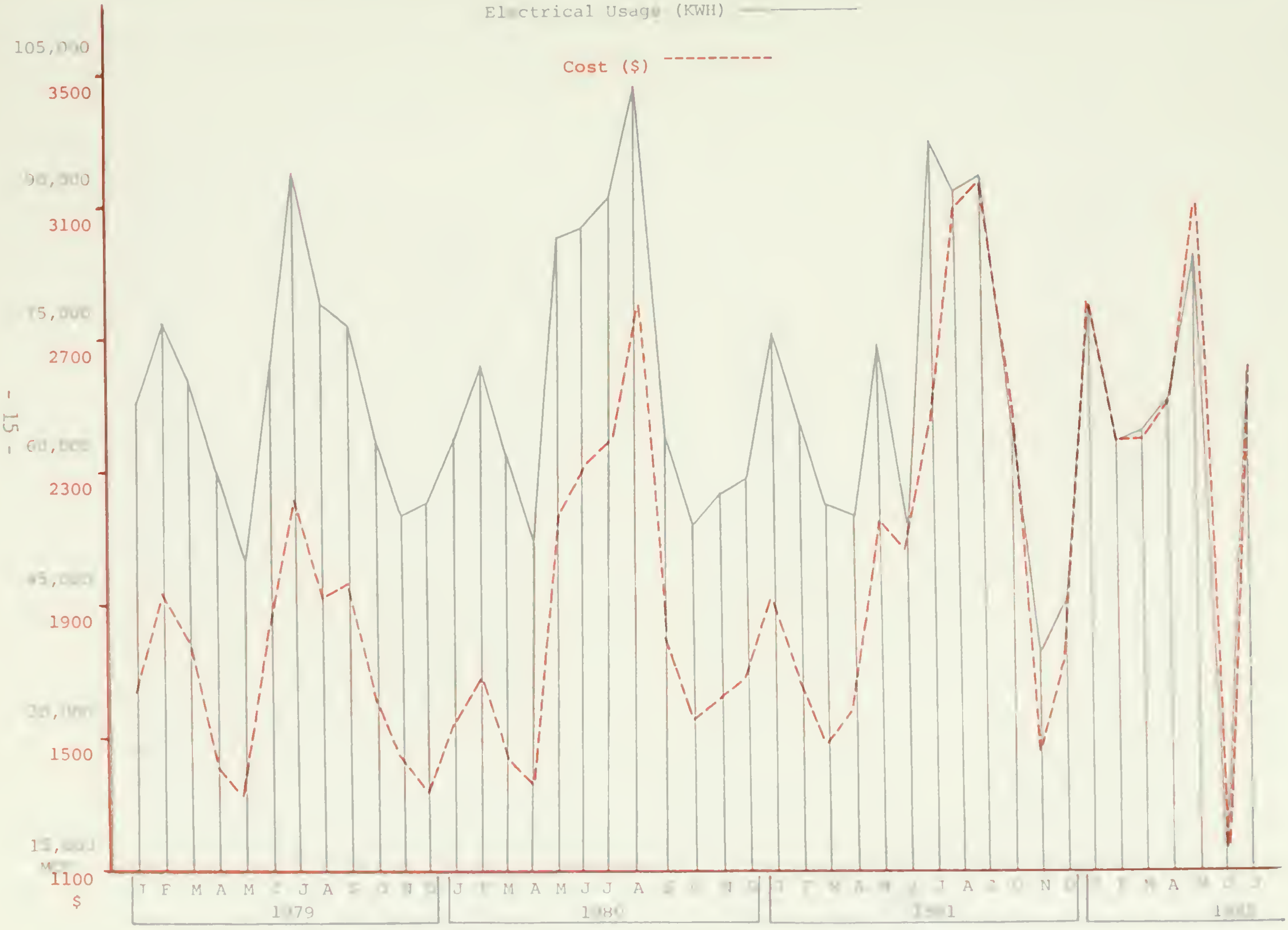

Cost ($)
240
200
160
120
80
40
0
$



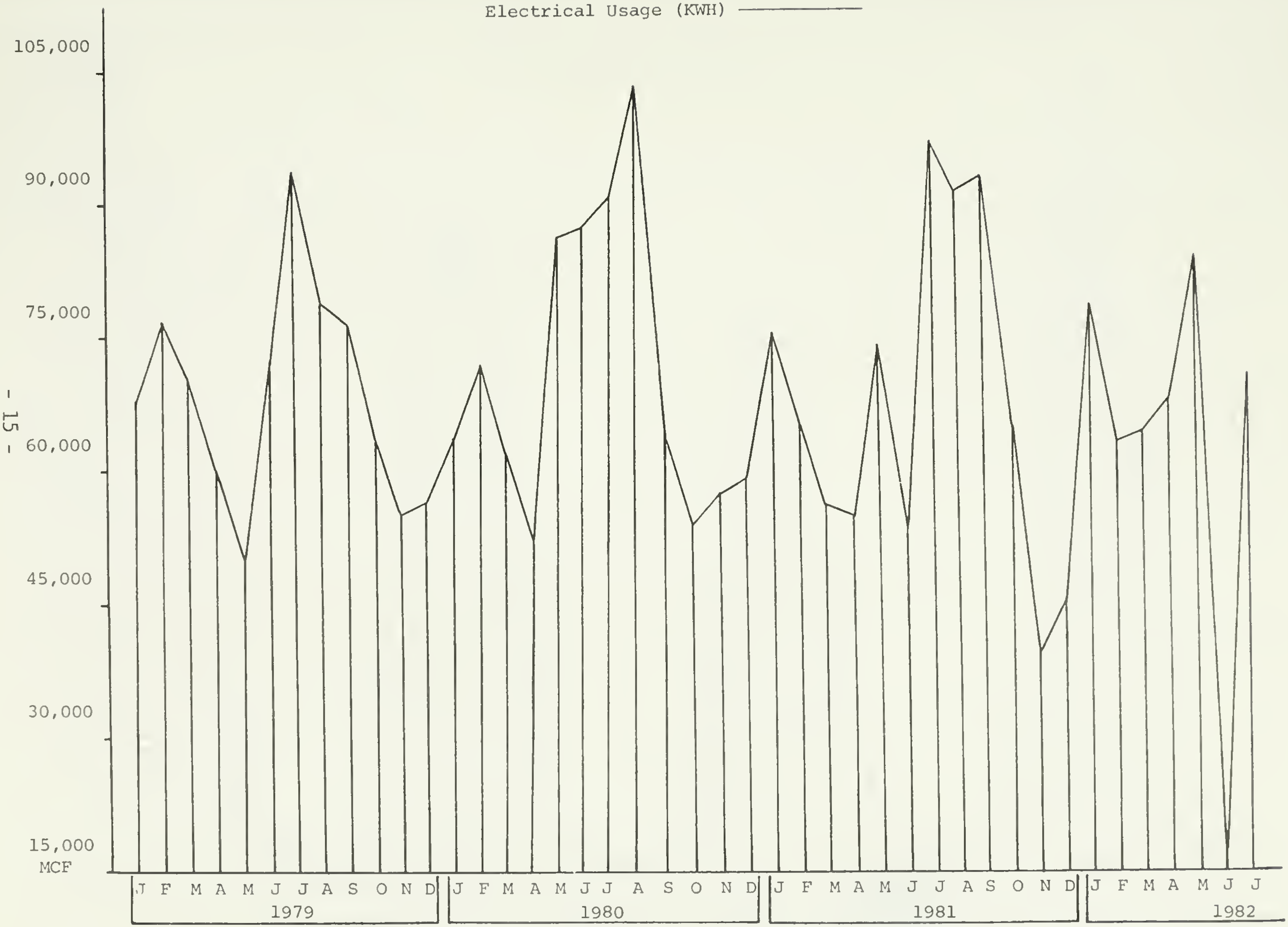
AIRPORT

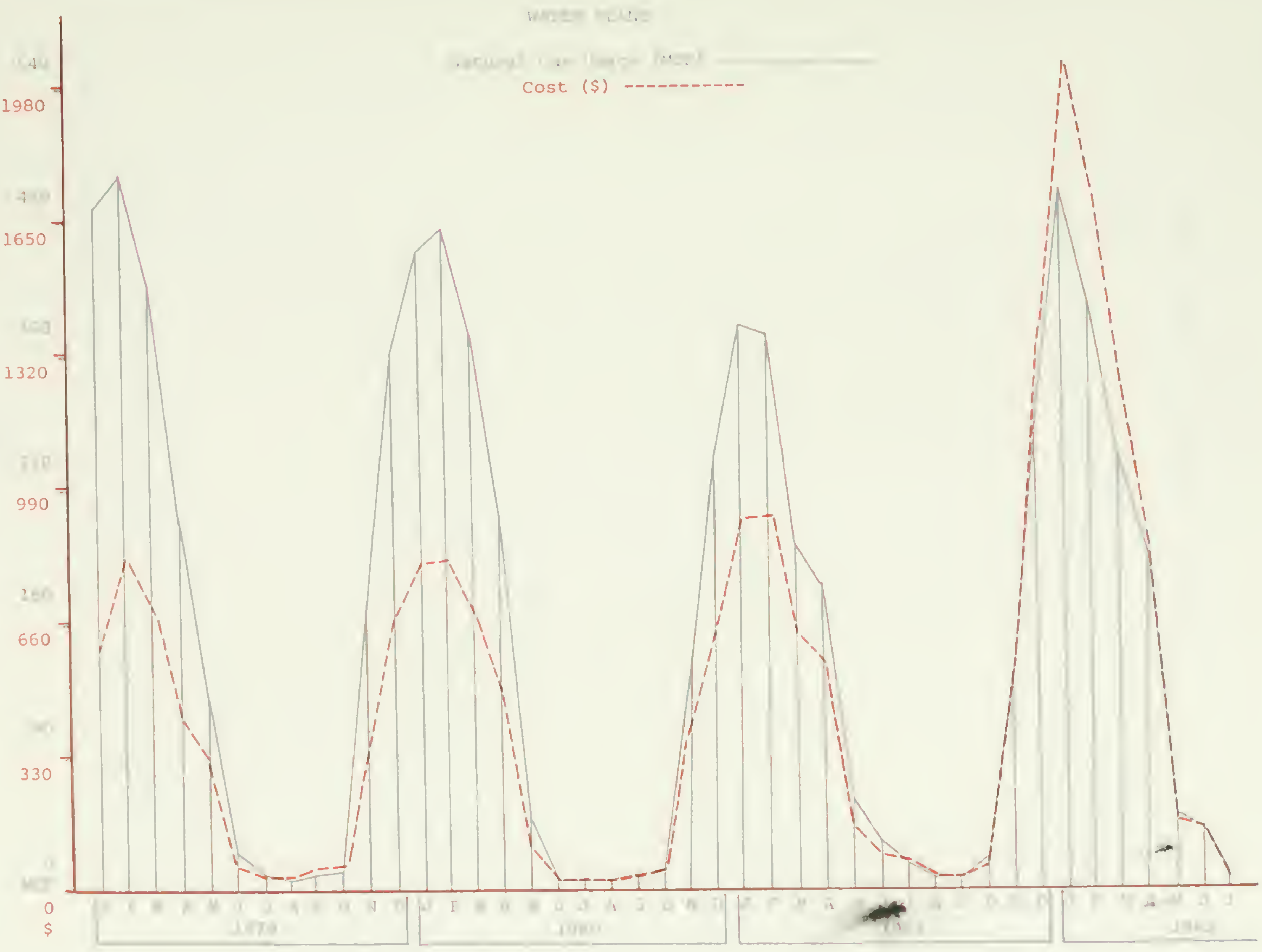
Natural Gas Usage (MCF) ———

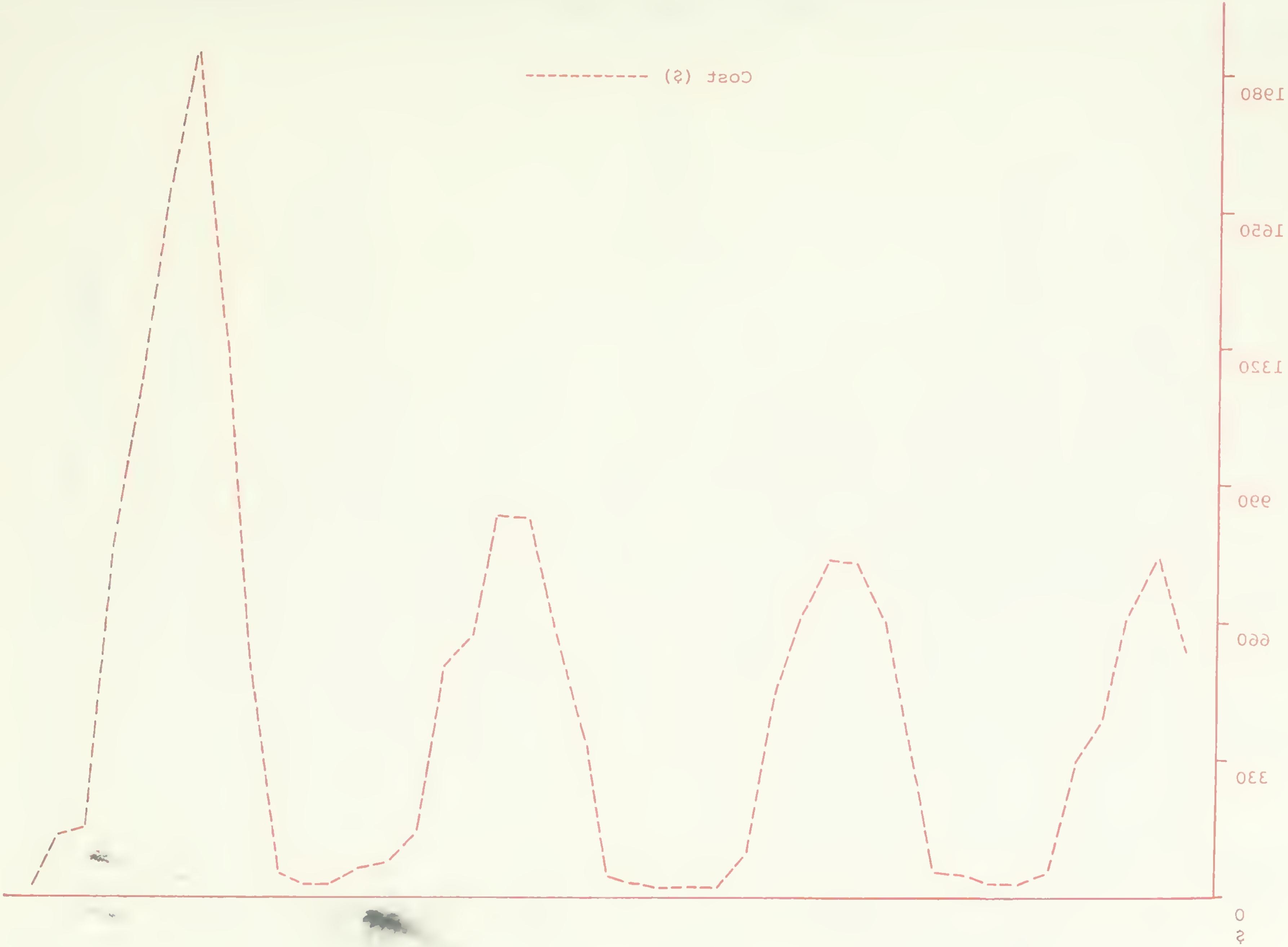
WATER PLANT


Electrical Usage (KWH)
Cost ($)
105,000
3500
90,000
3100
75,000
2700
60,000
2300
45,000
1900
30,000
1500
15,000
MO.
1100
$
J F M A M J J A S O N D
1979
J F M A M J J A S O N D
1980
J F M A M J J A S O N D
1981
J F M A M J J
1982

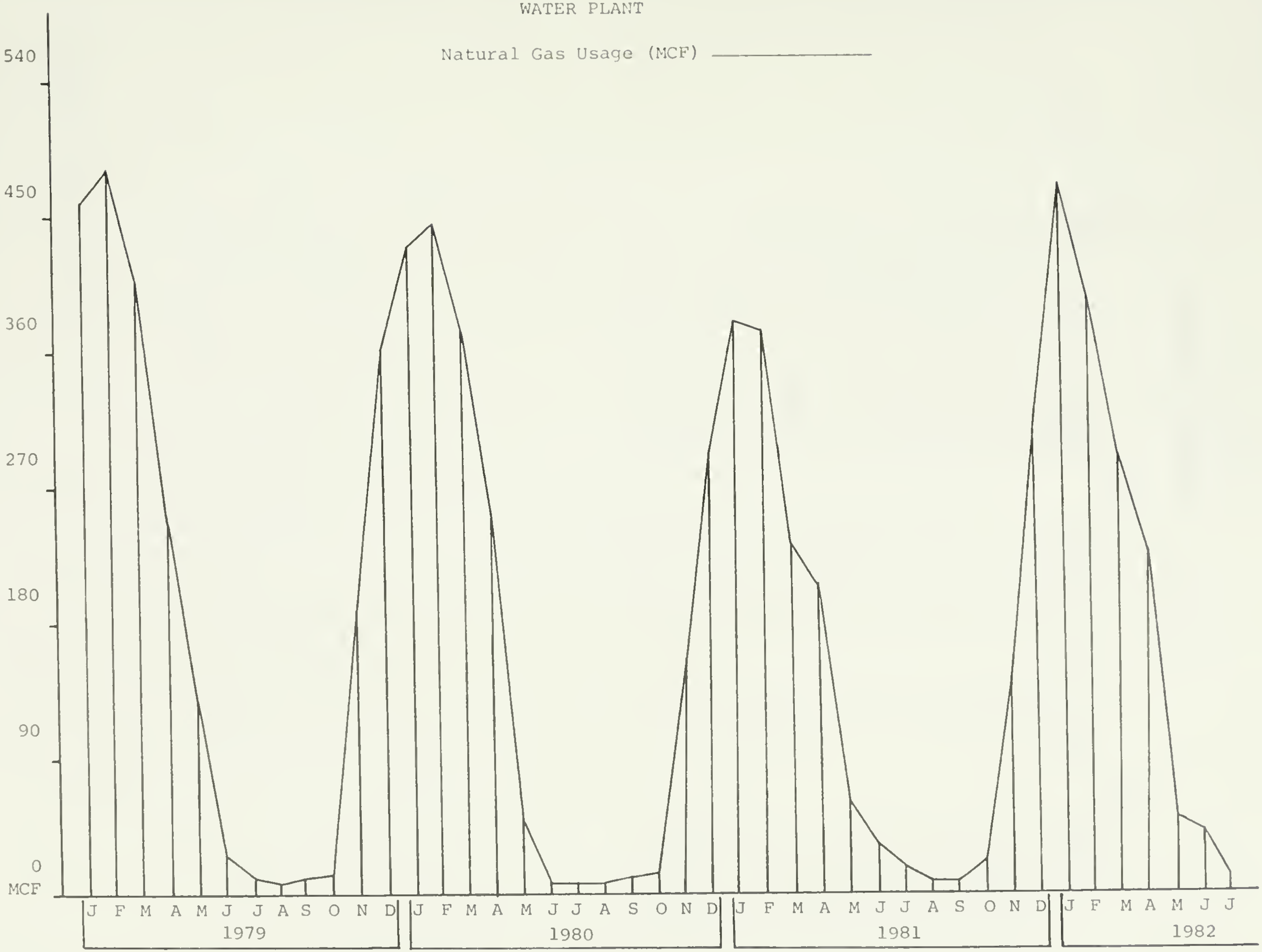
WATER PLANT


Electrical Usage (KWH)
105,000
90,000
75,000
60,000
45,000
30,000
15,000
MCF
J F M A M J J A S O N D
1979
J F M A M J J A S O N D
1980
J F M A M J J A S O N D
1981
J F M A M J J
1982


Cost ($)
1980
1650
1320
990
660
330
0
$


Cost ($)
1980
1650
1320
990
660
330
0
$

WATER PLANT


Natural Gas Usage (MCF)
540
450
360
270
180
90
0
MCF
J F M A M J J A S O N D
1979
J F M A M J J A S O N D
1980
J F M A M J J A S O N D
1981
J F M A M J J
1982

CITY OF MILES CITY

ENERGY CONSUMPTION/EXPENDITURES 1982-1990

	NAT. GAS		ELEC.		FUELS	
	Use (MCF)	Cost ($)	Use (KWH)	Cost ($)	Use (Gals.)	Cost ($)
1982	7,893.7	32,911.85	5,701.232	270,921.11	48,180	55,400.00
1983	6,154.	28,923.89	5,872.269	375,825.22	46,500	61,845.00
1984	6,154.	32,000.80	6,048.437	435,487.46	46,970	71,394.00
1985	6,154.	45,539.60	6,229.890	479,701.53	47,440	83,020.00
1986	6,154.	50,462.80	6,416.786	603,177.88	47,900	95,350.00
1987	6,154.	52,924.40	6,609.290	621,273.26	48,380	105,950.00
1988	6,154.	56,001.40	6,807.569	653,526.63	48,860	120,210.00
1989	6,154.	58,770.70	7,011.796	813,368.34	49,350	135,710.00
1990	6,154.	62,155.40	7,222.150	859,435.85	49,840	153,520.00

See appendix A for sources

To determine heat loss calculations for City buildings requiring significant space heating, as required by funding contract, an on-site visit and inspection of the structures was made. The on-site work resulted in both general comments and specific recommendations, in regards to energy consumption.

Knowledge of the total on-going operations housed in these structures was not assumed and the general comments portion of this report is designed for those individuals assigned management responsibilities; to use in a continuing study of their complex and its energy consumption. Areas, outside of the scope of this study and/or beyond the technical ability of those conducting the study, are also addressed in the general comments section. Further study and technical assistance for these areas is advised.

The specific recommendations contain cost estimated and calculated paybacks at current energy costs. The specific recommendations are prioritized and reflective of generally accepted energy conservation practices. As budget allows; the specific recommendations should be undertaken in order of their listing.

CITY OF MILES CITY - TOTAL USAGE

The City of Miles City's total energy expenditures have dramatically increased. The cause is twofold; first, increased energy costs and secondly, increased use. Any attempts to alter this trend will require specific record keeping and monitoring on a continuing basis. It is advised that these functions (record keeping and monitoring) be assigned to an existing managerial position within city government.

Total city and departmental usage is predictable on a year to year basis and lends itself to mathematical analysis of budgetary compliance. Only in this way can the City control its usage and resulting expenditures. City government officials must become more aggressive in their attention to the City's energy use.

HEAT LOSS CALCULATIONS - CITY HALL (3 FLOORS)

Conditioned envelope:

area: Walls - 10,168 sq.ft. Ceiling - 5,809 sq.ft. Floor - 5,809 sq.ft.

volume: 147,375.5 cu.ft.

construction materials and R values:

Double glazed windows	1,382.3	sq.ft.	(R=1.72)
Doors	435.4	"	(R=3)
Stone walls with plaster interior	8,350.3	"	(R=4)
Ceiling	5,809.	"	(R=5)

Heating/cooling Plants:

fuel type: Natural gas boiler

distribution method: Steam

Heat Loss Calculations:

Conductive: seasonal loss (BTU) = $\frac{\text{area (sq.ft.)} \times \text{degree days} \times 24}{\text{R-value}}$

Windows	150.23	MCF/yr	$ 592.66/yr
Doors	27.13	"	107.03/yr
Walls	390.24	"	1,539.50/yr
Ceiling	217.18	"	856.78/yr

Convective: seasonal loss (BTU) = volume (cu.ft.) x air change x heating capacity x degree days x 24

1,157.09 MCF/yr $4,564.72/yr

CITY HALL

General Comments

City Hall, in January, 1979, contained the present functions plus the Fire Department. In the summer of 1979, the Fire Department moved from City Hall to its own building. The use data for City Hall reflects the decreased occupancy. At the time of this study, the space occupied by the Fire Department in 1979, houses the Water Department Maintenance section and the Miles City Housing Authority and Action for Eastern Montana as tenants. The square foot data for City Hall demonstrates an excess of conditioned space for existing functions. A great deal of the excess space is basement level (abandoned by the Police Department in 1972.)

Action on specific recommendations needs to reflect a long range space utilization plan for City Hall. Areas that may not realistically be utilized in the future should be eliminated from any expenditures to renovate or retrofit. In specific areas (reflecting continuing occupancy) any retrofitting should be reflective of a larger scoped end product (ie. window retrofits done prior to lowered ceilings, should correspond to future ceiling levels.)

Ideally, comments regarding the heat plant and heat distribution system in City Hall would appear as specific recommendations, however to remain within the scope of this study, they are included as general comments. Heat control is inadequate for efficient operation and does not lend itself to a comfortable work environment. The current distribution system loses a great deal of heat in the unoccupied basement level. The ability to separately control and maintain the temperature in work and non-work areas is non-existant. Current water heating is excessive for present demand, however future use should be considered prior to reduction or elimination.

Specific Recommendations

1. Appointment of current City Hall employee as building manager. Duties would include, but not limited to: Reduction of thermostats at the close of the working day, making sure the lights are out, monitor non-working areas and control temperatures as necessary.

Estimated cost: 15 min/day

Estimated savings: 15 % of yearly total usage

Estimated payback: Immediate

2. Reduction of infiltration by patching holes, caulking, weatherstripping and correction of improper fitting windows.

   Estimated cost: $150.00

   Estimated savings: $215.00/year

   Estimated payback: 8.4 months

3. Service heating/cooling plants annually.

   Estimated cost: $150.00/year

   Estimated savings: $150.00/year

   Estimated payback: Annual

   Note: Cost and savings the 1st year of servicing will probably be higher.

4. Insulate garage doors (333 sq.ft.) possible retrofit is the use of High-R board (R=8).

   Estimated cost: $130.00

   Estimated savings: $85.00/year

   Estimated payback: 1.5 years

5. Lower existing ceilings on second floor and insulate to R-38.

   Estimated cost: Dependent on materials selected

   Estimated savings: $744.23/year

   Estimated payback: Dependent on materials selected

6. Reduce window area (north & northwest), replace front entry doors and increase R-value of exterior walls. This should be done in conjunction with major renovation; to reduce specific retrofit cost and maximize conservation savings.

HEAT LOSS CALCULATIONS - LIBRARY (INCL. GARAGE)

Conditioned envelope:

area: Walls - 6,824 sq.ft. Ceiling - 8,280 sq.ft. Floor - 8,280 sq.ft.

volume: 103,358 cu.ft.

construction materials and R values:

Single glazed windows	530.5 sq.ft.	(R=.58)
Doors	387.7 "	(R=2.3)
Walls	5,905.8 "	(R=4.2)
Ceiling	8,280 "	(R=6)

Heating/cooling Plants:

fuel type: Natural gas

distribution method: Forced air and recovery

Heat Loss Calculations:

Conductive: seasonal loss = $\frac{\text{area (sq.ft.) x degree days x 24}}{\text{R}}$

Single glazed windows	170.98 MCF/yr	$ 674.52
Doors	31.51 "	124.31
Walls	262.86 "	1,036.98
Ceiling	257.97 "	1,017.69

Convective: seasonal loss = volume (cu.ft.) x air change x heating capacity x degree days x 24

734.21 MCF/yr $2,896.46/yr

LIBRARY

General Comments

Utility usage at the City Library has continued to increase during the period selected for use history. During the on-site visit numerous problem areas became apparent and staff described the environment as difficult to maintain at a comfortable level. During heating periods some areas are too hot while other areas require additional space heating to condition. It is safe to assume that the same disparities exist when cooling of the environment is undertaken. The structure consists of the original building; plus an addition approximately fifteen years old.

Observations

Observations during the on-site visit and discussion with staff, reveals that maintenance work on the structure is not assigned on an on-going basis.

Specific Recommendations

1. Develop energy conservation awareness with staff and assign building manager duties to existing staff position.

   Estimated cost: No capital outlay

   Estimated savings: 15% - 20%

   Estimated payback: Immediate

2. Reduction of infiltration by caulking windows and weatherstripping doors.

   Estimated cost: $100.00

   Estimated savings: $152.00/yr

   Estimated payback: 7.8 months

3. Service heating/cooling plant and control system.

   Estimated cost: Unavailable

   Estimated savings: Unavailable

   Estimated payback: Unavailable

4. Insulate garage doors with high-R board.

   Estimated cost: $200.00

   Estimated savings: $113.19/yr

   Estimated payback: 1.8 years

5. Insulate attic of original structure to R-38.

Estimated cost: $1,200.00

Estimated savings: $240.09/yr

Estimated payback: 5 years

6. Installation of interior storm windows on all windows.

Estimated cost: $2,785.12

Estimated savings: $396.74/year

Estimated payback: 7 years

HEAT LOSS CALCULATIONS - CITY SHOP

Conditioned envelope:

area: Walls - 6,300 sq.ft. Ceiling - 11,025 sq.ft. Floor - 11,025 sq.ft.

volume: 165,375 cu.ft.

construction materials and R values:

Single glazed windows	54 sq.ft.	(R=.58)
Double glazed windows	203.3 "	(R=1.72)
Doors	1,238.3 "	(R=2.3)
Walls	6,300 "	(R=12)
Ceiling	11,025 "	(R=12)

Heating/cooling Plants:

fuel type: Natural gas

distribution method: Forced air (offices) Space ceiling (shops)

Heat Loss Calculations:

Conductive: $\text{seasonal loss (BTU)} = \dfrac{\text{area (sq.ft.)} \times \text{degree days} \times 24}{R}$

Single glazed windows	17.4 MCF/yr	$ 68.64/yr
Double glazed windows	22.1 "	87.18/yr
Doors	100.64 "	397.02/yr
Walls	98.14 "	387.16/yr
Ceiling	171.75 "	677.55/yr

Convective: seasonal loss (BTU) = volume (cu.ft.) x air change x heating capacity x degree days x 24

1,483.9 MCF/yr $ 5,853.99/yr

CITY SHOP

General Comments

The City Shop complex is currently housed in a converted wool warehouse consisting of office space, mechanics space, vehicle storage and materials storage. Temperatures required vary for each area, however, the existing floor plan does not lend itself to zone type environmental conditioning. Doors used for equipment entrance and exit are centrally located on each end of structure. At the time of the on-site visit a waste oil burning furnace was being installed in the mechanics area.

Specific Recommendations

1. Employee training to encourage conservation and increase awareness of utility usage.

   Estimated cost: No capital cost

   Estimated savings: 5% - 10%

   Payback period: Immediate

2. Scheduled vechicle wash to allow water heater to be turned off until hot water is needed.

   Estimated cost: None

   Estimated savings: Direct

   Payback period: Immediate

3. Close off northeasterly equipment doors during winter months and use only southwesterly doors.

Estimated cost: $60.00

Estimated savings: $487.89/yr

Estimated payback: 1.4 months

4. Service and maintenance to heating/cooling units on yearly basis.

   Estimated cost: $150.00

   Estimated savings: $300.00

   Payback period: 6 months

5. Eliminate windows on northeast and northwest walls.

   Estimated cost: $150.00

   Estimated savings: $36.89/year

   Estimated payback: 4 years

6. Insulation of ceiling to R-39 from existing R-12 would save $469.10/yr at present cost. Existing ceiling does not lend itself to easy installation of additional insulation, however, insulation should be done in conjunction with any future work on ceiling or roof.

HEAT LOSS CALCULATIONS - FIRE HALL

Conditioned envelope:

area: Walls - 4,142 sq.ft. Ceiling - 1,565 sq.ft. Floor - 1,565 sq.ft.

volume: 89,880 cu.ft.

construction materials and R values:

Single glaze windows	280	sq.ft.	(R=.58)
Double glaze windows	93.3	"	(R=1.72)
Doors	941.9	"	(R=2.3)
Walls	4,142	"	(R=12)
Ceiling	1,565	"	(R=12)

Heating/cooling Plants:

fuel type: Natural gas

distribution method: Forced air

Heat Loss Calculations:

Conductive: $$\text{seasonal loss (BTU)} = \frac{\text{area (sq.ft.)} \times \text{degree days} \times 24}{\text{R-value}}$$

Single glazed windows	90.24 MCF/yr	$ 356.00/yr
Double glazed windows	10.14 "	40.00/yr
Doors	76.55 "	301.00/yr
Walls	64.52 "	254.53/yr
Ceiling	24.38 "	96.18/yr

Convective: $$\text{seasonal loss (BTU)} = \text{volume (cu.ft.)} \times \text{air change} \times \text{heating capacity} \times \text{degree days} \times 24$$

571.26 MCF/yr $2,253.62/yr

FIRE HALL

General Comments

The Fire Department moved to their present location during the summer of 1979. In viewing the utility usage of this department it is significant to note that the department is a 24 hour a day, 365 days a year operation. The facilities contain office space, living quarters, mechanic area, truck and ambulance storage and materials storage. Limited zoning of environmental conditioning is possible. Truck and ambulance doors are located on the north side of building and structure doesn't encourage movement to any other location on structure. Currently there is no method of closing the doors as all staff respond to calls. A fifteen to twenty minute delay occurs prior to additional staff arriving.

Specific Recommendations

1. Employee training to encourage conservation and increase awareness of utility usage.

   Estimated cost: No capital cost

   Estimated savings: 5%

   Estimated payback: Immediate

2. Service and maintenance of heating/cooling plants.

   Estimated cost: $150.00

   Estimated savings: 20%

   Estimated payback: 6 months

3. Caulk and weatherstrip all openings in envelope.

   Estimated cost: $100.00

   Estimated savings: $132.60/yr

   Estimated payback: 9 months

4. Eliminate windows on east block annex portion of structure (164 sq.ft.)

   Estimated cost: $200.00

   Estimated savings: $202.14/yr

   Estimated payback: 1.01 years

5. Insulate attic to R-39 value.

   Estimated cost: $657.30

   Estimated savings: $66.60/yr

   Estimated payback: 9.86 years

HEAT LOSS CALCULATIONS - AIRPORT BLDG. #1
(office & mechanics hanger)

Conditioned envelope:

area: Ceiling - 7780 sq.ft.
Hanger - 5,000 "
Floor - 7,780 sq.ft.
Office - (3 walls) - 1,008 sq.ft.

volume: Office - 11,520 cu.ft. Hanger - 98,000 cu.ft.

construction materials and R values:

Single glazed glass	56	sq.ft.	(R=.58)
Ceiling (hanger)	4,900	"	(R=11.2)
Door (hanger)	18	"	(R=7)
Walls (hangers)	4,926	"	(R=11.2)
Double glazed glass	148.8	"	(R=1.72)
Walls (office)	838.2	"	(R=11.65)
Ceiling (office)	1,440	"	(R=19)
Door (office)	21.	"	(R=1.72)

Heating/cooling Plants:

fuel type: Natural gas

distribution method: Hanger - spaceheater, floor heat
Office - central air

Heat Loss Calculations:

Conductive: seasonal loss (BTU) = $\frac{\text{area (sq.ft.)} \times \text{degree days} \times 24}{R}$

Hanger:	Ceiling	81.8 MCF/yr	$ 322.62/yr
	Wall	82.2 "	324.36/yr
	Single glazed glass	18.1 "	71.21/yr
	Door	.5 "	1.89/yr
Office:	Ceiling	14.2 "	55.90/yr
	Wall	16.2 "	63.79/yr
	Double glazed glass	16.2 "	63.79/yr
	Door	2.3 "	8.99/yr

Convective: seasonal loss (BTU) = volume (cu.ft.) x air change x heating capacity x degree days x 24

Office:	73.2 MCF/yr	$ 288.85/yr
Hanger:	696.2 "	2,746.31/yr

HEAT LOSS CALCULATIONS - AIRPORT BLDG. #2 (former office)

Conditioned envelope:

area: Walls - 1,280 sq.ft. Ceiling - 1,200 sq.ft. Floor - 1,200 sq.ft.

volume: 9,600 cu.ft.

construction materials and R. values:

Walls	1,073.9 sq.ft.	(R=11)
Ceilings	1,200 "	(R=1.2)
Single glazed	137.7 "	(R=.58)
Double glazed	14.7 "	(R=1.89)
Doors	53.7 "	(R=2.2)

Heating/cooling Plants:

fuel type: Natural gas

distribution method: Forced air

Heat Loss Calculations:

Conductive: seasonal loss (BTU) = $\frac{\text{area (sq.ft.) x degree days x 24}}{\text{R}}$

Walls	18.3 MCF/yr	$ 72.00/yr
Ceiling	186.9 "	737.48/yr
Single glazed	44.4 "	175.08/yr
Double glazed	1.5 "	5.72/yr
Doors	4.6 "	17.99/yr

Convective: seasonal loss (BTU) = volume (cu.ft.) x air change x heating capacity x degree days x 24

53.8 MCF/yr $212.40/yr

HEAT LOSS CALCULATIONS - AIRPORT FIRE STATION

Conditioned envelope:

area: Walls - 1,848 sq.ft. Ceiling - 1,440 sq.ft. Floor - 1,440 sq.ft.

volume: 17,280 cu.ft.

construction materials and R values:

Door	21 sq.ft.	(R=7)
Doors	203.3 "	(R=.65)
Ceiling	1,440 "	(R=11.2)
Walls	1,623.7 "	(R=11.2)

Heating/cooling Plants:

fuel type: Natural gas

distribution method: Ceiling mounted space heaters

Heat Loss Calculations:

Conductive: seasonal loss (BTU) = $\frac{\text{area (sq.ft.) x degree days x 24}}{\text{R-value}}$

Walls	27.1 MCF/yr	$ 106.91/yr
Ceiling	24. "	94.80/yr
Door	.6 "	2.21/yr
Doors (garage)	58.5 "	230.66/yr

Convective: seasonal loss (BTU) = volume (cu.ft.) x air change x heating capacity x degree days x 24

64.6 MCF/yr $ 254.89/yr

AIRPORT

General Comments

Usage history for the Airport Complex demonstrates conservation efforts to be an integral part of standard operating procedures. The on-site visit and discussions with management revealed an excellent awareness of conservation techniques and good effort at implementation.

Specific Recommendations

1. Continue efforts to eliminate runway lighting except when needed. Maintain safety standards.

   Estimated cost: NA

   Estimated savings: Unavailable at this time

   Estimated payback: Immediate

2. Convert abandoned office building to dark, cold storage if other use is not contemplated in near future.

   Estimated cost: NA

   Estimated savings: 100% for that building

   Estimated payback: Immediate

3. To reduce infiltration, caulk and weatherstrip all openings in main office and mechanics hanger.

   Estimated cost: $100.00

   Estimated savings: $144.55/yr

   Estimated payback: 8.28 months

HEAT LOSS CALCULATIONS - WATER PLANT

Conditioned envelope:

area: Walls - 13,752 sq.ft. Ceiling - 20,520 sq.ft. Floor - 20,520 sq.ft.

volume: 492,480 cu.ft.

construction materials and R values:

Single glaze windows	99.6	sq.ft.	(R=.58)
Double glaze windows	69.3	"	(R=1.3)
Doors	222.8	"	(R=1.3)
8" Cinder block	13,360.3	"	(R=1.72)
Floor (6" concrete)	20,520.	"	(R=1.3)
Ceiling (6" concrete/2"beaboard/roofing)	20,520	sq.ft.	(R=8.9)

Heating/cooling Plants:

fuel type: Natural gas

distribution method: Ceiling mounted space heaters

Heat Loss Calculations:

Conductive: $$\text{seasonal loss (BTU)} = \frac{\text{area (sq.ft.)} \times \text{degree days} \times 24}{R}$$

Block walls	1,494.6 MCF/yr	$5,896.28/yr
Ceiling	431. "	1,700.30/yr
Single glazed windows	32.1 "	126.63/yr
Double glazed windows	7.5 "	29.71/yr
Doors	32. "	126.40/yr

Convective: seasonal loss (BTU) = volume cu.ft. x air change (1.3) x heating (.02) capacity x degree days x 24

2,393.6 MCF/yr $9,442.83/yr

WATER PLANT

General Comments

The water treatment plant was built in 1974, however construction does not demonstrate priority on energy conservation when dealing with heating the massive volumes involved. Wall construction is of 8" block with no insulation. R-value is equivalent to a double glazed window with ¼" air space. In addition to the volume of the building, an enormous volume of water of varying temperatures passes through the conditioned environment. As long as the water is cooler than the air temperature a tremendous heat loss occurs to the water. A much more technical study needs to be conducted to deal with the heat loss to water mass. The large KWH usage in pumping may be worthy of a wind generated source feasibility study.

Specific Recommendations

1. Conservation techniques and awareness training for staff.

   Estimated cost: None

   Estimated savings: 5%

   Estimated payback: Immediate

2. Caulk and weatherstrip all openings in the conditioned envelope.

   Estimated cost: $30.00

   Estimated savings: $76.40/yr

   Estimated payback: 4.68 months

3. Service and maintenance yearly on heating/cooling plants.

   Estimated cost: $150.00

   Estimated savings: $250.00/yr

   Estimated payback: 7.2 months

MOTOR FUELS

General Comments

City usage of motor fuels, of all types, appears to correlate with the severity of the winter months, similar to natural gas usage. It is assumed that the severity of winter results in increased snow removal tasks, sanding of streets and intersections and in all probability, vehicles and equipment are left to idle longer. Consequently, specific projections of usage for any given year would require better weather forecasting than currently is available. An average usage projection is valuable to demonstrate the increase in cost, however, this should cautiously be used as a budgetary tool for any given fiscal year.

The specific recommendations section of motor fuel usage analysis does not contain specific savings and payback data due to a lack of historical use data and reflective of departmental monitoring. Savings and payback data require specific past pattern data to reference from.

Specific Recommendations

1. A metering and monitoring capability must be established at the location of motor fuel dispersal. Without this capability any control over usage and resulting departmental budgetary liability is impossible. A metering/monitoring system will also enhance appropriate dispersal. City personnel policies should reflect specific consequences to facilitate enforcement measures.

2. A program focusing on motor fuel consumption patterns and conservation measures should be established for all city employees utilizing city vehicles and be a part of general orientation for all new city employees. Attention to and awareness of conservation techniques is proven measure for reduction of consumption.

3. City personnel policies should be established to document employees that are allowed access to and use of city vehicles and fuels for non-working hours. Establishment of policies, in writing, will allow reviewing this usage as an official fringe benefit rather than an "unwritten benefit." This can be adjusted according to actual expenditures during salary negotiations. The benefit in 1982, for example, is worth approximately three times the value it contained in 1979.

4. All department heads should be required to present inventory reduction proposals to the City Council regarding vehicles and equipment. Older vehicles may not be needed and definitely are not as efficient. Insurance and maintenance cost savings would also result from any reduction in fleet.

5. A pilot conversion of a law enforcement vehicle to LPG should be instituted at the earliest possible date. Numerous studies are available from other municipalities that demonstrate significant savings and employee satisfaction with LPG conversions. LPG conversions result in savings in fuel costs, maintenance and replacement.

CITY OF MILES CITY

ENERGY EXPENDITURES

1983 - 1987

WITH & WITHOUT CONSERVATION RETROFITS

Without		With
1983	$ 466,594.00	$ 396,605.00
1984	538,882.00	484,993.00
1985	608,261.00	565,682.00
1986	748,990.00	696,561.00
1987	780,147.00	702,132.00

The projection of energy expenditures with retrofits utilizes the low cost/no cost procedures outlined in the specific recommendations. The amount of savings will be greatest the first year, per centage wise, as employee awareness and training is implemented. Suceeding years will see further savings through continued awareness, training and implementation of retrofits, made possible by conservation savings. Total expenditures will continue to increase, but at a reduced rate and due solely to the projected increase in rate structure.

MONTANA-DAKOTA UTILITIES CO.

PROJECTED RATES - MONTANA

1982 - 1990

NATURAL GAS ($/MCF)

Year	Residential	Industrial
1982	$ 3.945	$ 3.945
1983	4.70	4.70
1984	5.20	5.20
1985	7.40	7.60
1986	8.20	8.40
1987	8.60	8.85
1988	9.10	9.30
1989	9.55	9.80
1990	10.10	10.35

ELECTRIC SERVICE (¢/KWH)

Year	Residential	Commercial	Municipal Lighting	Pumping
1982	6.90	4.80	4.548	4.548
1983	7.20	5.40	6.40	3.60
1984	8.10	6.00	7.20	4.10
1985	8.60	6.40	7.70	4.40
1986	10.20	7.70	9.40	5.40
1987	10.40	7.90	9.40	5.60
1988	10.60	8.10	9.60	5.80
1989	12.50	9.70	11.60	7.10
1990	12.80	9.90	11.90	7.40

PROJECTED GASOLINE PRICE INCREASES

(Source: February 1982, U.S. Department of Energy Annual Report to Congress)

Assumption: "These projections do not include the possibility of a future sudden disruption of world oil markets, although two such disruptions have occurred in the recent past--the 1973-1974 embargo and the Iranian revolution."

---DOE Annual Report

PERIOD	ANNUAL % INCREASE
1980-1985	15%
1986-1990	12%